SIGNAL

August 1959

13TH ANNUAL AFCEA CONVENTION REPORT ISSUE

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30mc PULSE RATE SWITCHES

Type Number	h_{fe}	Typical Power Gain	Typical Switching Times (Saturated Test Circuits)
2N1199	12-60 (DC)		t_r 35 mμsec t_s 10 mμsec t_f 25 mμsec
2N1267	6-18	25 db at 4.3 mc	
2N1268	11-36		
2N1269	28-90		
2N1270	6-18	25 db at 12.5 mc	
2N1271	11-36		
2N1272	28-90		

Maximum V_{cb}—20 V
Maximum temperature—150° C
Maximum dissipation—100 MW

60mc AMPLIFIERS

2N1199
This high speed switch has exceptionally low saturation voltage (typically 0.125 V), permitting *practical* design of 5 mc pulse circuits, using conventional saturated switching configurations. 30 mc pulse rates are obtainable in *practical* circuits using non-saturating techniques.

2N1267-68-69
The high gain characteristics of these units make possible the design of high efficiency IF amplifier circuits for communications equipment. These devices have unusually low collector capacitance . . . typically 1.5 $\mu\mu$f . . . and are available with restricted beta ranges to simplify design problems.

2N1270-71-72
The excellent high frequency response of these transistors makes practical the design of high performance communications systems at frequencies up to 60 mc. They have the same low collector capacitance and are available with restricted beta ranges.

Immediately available for prototype design from your Philco Industrial Semiconductor Distributor.

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"No man can improve an original invention..."

—William Blake

THERE are many scientists today who would argue this point with Blake.

At Bell Telephone Laboratories, for example, we have seen original inventions improved and re-improved countless times, the better to serve mankind.

But William Blake went on to say "... nor can an original invention exist without execution organized, delineated and articulated." Here Blake expressed ideas that apply with striking emphasis today. At Bell Laboratories organized effort is constantly aimed at fostering an environment in which inventions can exist and prosper, where they can be expressed either as ideas or in physical form, and where clear understanding of their principles can be achieved.

Indeed, Bell Laboratories scientists have made contributions to the art of communications which have twice earned Nobel prizes, and which have helped create the most efficient and versatile telephone system ever known. Bell Laboratories research and engineering serve the country, too ... in such projects as—among others—guidance systems for the Nike and Titan missiles, the DEW line, SAGE, the Alaska Military Network.

William Blake (1757-1827), a versatile genius, was famous for brilliant, sometimes prophetic, insights which he expressed with provocative beauty in drawing, painting, poetry and prose.

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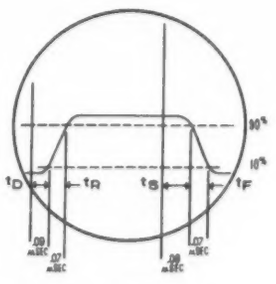
- high breakdown voltage and punch-through voltage ratings—the result of the diffusion process
- high power dissipation—150 milliwatts at 25°C—aids in the design of reliable circuits
- high current ratings—improve overall system speed
- rugged overall design—units have unusual capabilities to withstand severe drop tests and electrical overloads
- electrical uniformity—a result of the diffused-junction process used by RCA in the manufacture of Mesa Transistors
- especially well suited for use at pulse repetition rates up to 20 Mc
- exceptionally well suited to applications in saturation-type switching circuits

Information on RCA-2N1300 and 2N1301 Low-Cost Mesa Transistors is available from your RCA Field Representative. For technical data, write RCA Commercial Engineering, Section H-60-NN, Somerville, N. J.

RCA TYPE	Maximum Ratings* Absolute-Maximum Values						Characteristics: Common-Emitter Circuit, Base Input Ambient Temperature of 25° C		
	Collector-to-Base Volts	Emitter-to-Base Volts	Collector Milli-amperes	Transistor Dissipation—mw			Minimum DC Current Gain		Gain Bandwidth Product• Mc
				at 25°C	at 55°C	at 71°C	at collector ma = −10	at collector ma = −40	
2N1300	−13	−1	−100	150	75	35	30	–	40
2N1301	−13	−4	−100	150	75	35	30	40	60

*Maximum collector-to-emitter voltage rating = −12 volts

• For collector ma = −10 and collector-to-emitter volts = −3.



Oscilloscope wave form shows typical delay, rise, storage, and fall times achieved with 10-ma inverter circuit utilizing the RCA-2N1301 MESA TRANSISTOR.

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BPA

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At AFCEA Convention entrance, Adler Electronics, Inc. displays latest U. S. Army Signal air-transportable long-range communications unit AN/TSC-16. Photo by USAPS.

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AFCEA CONVENTION REPORT

featuring: *panels* *photos* *addresses* *presentations*

ISSUE

BENJAMIN H. OLIVER
Vice President, Upstate
New York Telephone Co.
National President, AFCEA

Welcome

IT IS A PRIVILEGE to introduce our new National President to the Armed Forces Communications and Electronics Association and its many friends.

Born in New York City on March 1, 1907, Mr. Oliver attended Brooklyn Technical High School and in 1928 graduated from Stevens Institute of Technology with a degree in mechanical engineering. He entered the New York Telephone Company in 1928 as a student engineer and continued his engineering studies in evening classes at New York University. He held many assignments before his appointment in 1952 as general plant manager, Long Island. In June 1955 he went to the American Telephone and Telegraph Company as assistant vice president-plant operations and returned to the New York Telephone Company on February 15, 1958, as vice president for Upstate New York territory.

Mr. Oliver went on active military duty with the 99th Signal Battalion as a Captain at the beginning of World War II. He served as a Major in the Seventh Army Corps and later in the 305th Signal Operation Battalion, and in August 1943, became a Lieutenant Colonel with the 35th Infantry Division. Among other decorations, his distinguished service earned for him the Bronze Star with Cluster and a promotion to the rank of Colonel before returning to inactive duty in September 1945.

Mr. Oliver is a member of the Capitol City Post (No. 225 American Legion, the 35th Division Association, and is a director of the State Bank of Albany, Director of the Albany County Chapter, American Red Cross, Director of the Parents Association of Syracuse University, Director of Trinity Institute, Inc., and a member of the Planning-Advisory Board of Memorial Hospital Development Program in Albany. He is a member of the Fort Orange Club and the Albany Country Club.

The entire membership of AFCEA joins in congratulating Mr. Oliver (Ben) on his selection as National President. We recognize him as a prodigious worker, a respected executive and a capable leader.

Photo by USAPS

Some of the 1200 Banquet Guests

Photo by USAPS

Some of the 1200 Banquet Guests

1959 AFCEA NATIONAL CONVENTION HIGHLIGHTS

by W. J. Baird

Editor

IN KEEPING WITH our Convention theme, "Communications, Electronics, Photography—Hallmarks of Outer Space," the 13th Annual Armed Forces Communications and Electronics Association Convention through its quality exhibits, panel presentations, distinguished speakers, social and other programmed events, authoritatively earned its own official stamp of recognition. In the history of AFCEA conventions, never were so many as well pleased with our Electronics Show, the fourth largest nationally and tops in the Nation's Capital.

Starting at a much earlier date than previously, William C. Copp and Associates worked assiduously on this show of shows with rewarding results. Mr. Copp's success was evidenced by the 140 striking exhibits and our largest attendance record of 4126. Represented in the attendance figure were foremost industrial leaders, government executives, top-flight military leaders, educators and scientists, 'ham' radio enthusiasts and countless others, all interested in the products exhibited. Such an audience was in itself most meaningful and profoundly appreciated by the exhibitors.

National Headquarters wishes to express its appreciation to the following committee members who worked behind the scenes and whose prior planning was much in evidence once the show got on the road: Convention Chairman, W. B. Goulett; Exhibits, William C. Copp; Panels, Dwight M. Agnew; Entertainment, W. D. Myers; Epicure, Frank Clarke; Tours and Transportation, Ralph I. Cole; Reception and Hospitality, Murrey Royar and G. L. McGowen; Invitations, Julia Godfrey; Publicity and Public Relations, Thomas E. Gootee and W. J. Baird; Keynote Luncheon, J. F. Whitehead; Buffet and Reception, Murray Block and F. W. McDermott; Industrial Luncheon, E. A. Corey; Ladies Activities, Elizabeth J. Goulett; Treasurer, Thomas B. Jacocks and Frank Martins; Advisory Group, Percy G. Black, Francis H. Engel, John R. O'Brien and Millard C. Richmond.

Press and Radio

SIGNAL Magazine is most appreciative to the press for its excellent coverage of the Convention. This, coupled with the NBC broadcast of Alex Dreier's national tribute to AFCEA over 200 radio stations, prior to the Convention, and to a listening audience of 9 million people (tribute on page 27) focused considerable interest prior to the opening of the Convention, and contributed materially to our record attendance. A special tribute is due also to the increasing number of National Directors, Officers and Chapter Presidents of the Association, who took time from their heavy work schedules to attend meetings and remain through the Convention activities.

Panel Presentations

This year AFCEA inaugurated an educational program via the panel conference discussion approach instead of the purely technical paper presentations of previous years, and with much success. In the six panels, a total of 30 panel members, all experts in their field, made outstanding contributions, and AFCEA is deeply indebted to all of them for their participation. RAdm. Dwight M. Agnew, USN (Ret.), Panel Chairman, and panel moderators (see page 24) are to be commended highly for their leadership in organizing the panels and arranging for subject material of a progressive nature and with future application in this space age.

Observations

Another successful feature of this year's Convention was the program of Ladies' Activities arranged by Mrs. W. B. Goulett. A total of 31 ladies attended and participated in the many events scheduled for their enjoyment. Mrs. Goulett's report on the ladies' program appears on page 45 of this issue.

For the second year, we are indebted to the Department of the Navy for installing an AFCEA ham radio station at the Sheraton-Park Hotel, K4NAA/3. Besides providing our convention membership with a readily available communications service throughout the convention, K4NAA/3 was in communication with other hams around the world.

The members of National Headquarters gave unselfishly of their time before and during the Convention. Their contributions and services to the success of the Convention were invaluable. Mr. John Ferguson III, Monumental Printing Company, Baltimore, Maryland; Mr. Lynn Anderson, D. C. Engraving Company, Washington, D. C., Mr. William Robinette, Art Consultant, Washington, D. C., and the editorial staff of SIGNAL once again produced a Convention issue and program of quality and content.

Another highlight of the Convention was the presentation made by retiring President RAdm. Furth to the Chapter contributing the most during the year to the promotion of science and engineering education in the field of electronics. The National Headquarters plaque was presented to James J. Magill, past president of the Dayton-Wright Chapter.

SIGNAL Magazine wishes to express its sincere thanks and appreciation to our exhibitors and advertisers for their support and interest in the 1959 Armed Forces Communications and Electronics Association Convention.

Photos upper half: Sheraton-Park Hotel
Photos lower half: USAPS

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First to design and produce "Submin" Transistors 10

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KEYNOTE LUNCHEON ADDRESS

by GENERAL CURTIS E. LEMAY

Vice Chief of Staff, USAF

I WELCOME THIS occasion to discuss a subject of extreme mutual interest and critical national precedence —the subject of military communications. I would like to talk about some of our defense problems—and their dependence upon the most efficient and effective communication systems possible. Since the Air Force is my business, I will confine my discussion to its problems and its programs.

The world as man once knew it is shrinking at an alarming rate. Of course, I am speaking figuratively—but nonetheless, accurately. It took the Pilgrims 54 days from the time they left England to sight Cape Cod. Modern ships make the same journey in 5 or 6 days; jet aircraft do it in a matter of a few hours; missiles could do it within minutes. Relatively speaking then, if one were to consider the earth in the days of the Pilgrims as the size of a basketball—now, it is the size of a pea.

Many factors have contributed to this phenomenon, but the two areas which have had the greatest impact—are communications and transportation. Improved speed, range and load capabilities in each of these very vital fields have contributed, and are contributing today, to the continuous compression of the globe. This remarkable progress has brought many new benefits to civilization—and at the same time, has presented us with many new problems.

The problems to which I refer have their origin in the application of these new developments to military capabilities. For example, I think we all agree that a means to transport cargo and personnel from one part of the world to another in a few short hours would certainly be considered beneficial progress. On the other hand, when the same development is used to transport lethal weapons of tremendous destructive power at supersonic —or even hypersonic—speeds, our accrued benefits quickly revert to ominous military threats.

The United States was at one time considered relatively immune to surprise attack by any major power in the world. However, as the Soviets have developed, in rapid succession, first long range bombers, then atomic weapons and finally intercontinental ballistic missiles, we have found that we no longer possess this immunity. Furthermore, as individual weapons grow in destructive power, the great advantages which we originally possessed in our atomic superiority have come to mean less. I do not mean that we have been overtaken in our capabilities to design, produce and operate better machines or weapons. However, I am firmly convinced that as each new development appears on the scene—as weapons become more powerful and their means of delivery more rapid and with greater range—the lead which we do possess guarantees us less and less advantage.

In the face of this growing threat, the defense policy of this country has been— and is today—to deter war, if possible, and if that deterrence should fail, to repel and decisively counter any attack against us. If we are to be successful in our deterrent efforts, we must be able to meet any military situation which might confront us—including surprise attack by the most powerful weapons—and still maintain the necessary residual strength for a decisive retaliatory blow. We earnestly hope that we will be successful in deterring an attack upon our country—or upon the free world forces—but we certainly cannot be positive that we will.

Let us look closely, then, at the requirement to repel and effectively counter any attack. As I said before, the biggest problem which faces us today—and which will increase as Soviet ballistic missiles become operational—is that of protecting our forces from a devastating surprise attack. In order to be prepared for the worst, we must always think in terms of having to absorb the initial blow. If we can do this, we will then continue to possess the dominant military capability.

To do this, we must provide the necessary protection for our weapons which will insure that, regardless of the power, size or speed of any attack against us, our forces will be available and usable. We are taking advantage of every measure available to us—warning, alert, dispersal, hardening, and mobility—to name a few. Maximum *warning* in combination with maximum *alert measures* guarantees the greatest number of forces launched in the shortest length of time. Furthermore, wide dispersal through a large number of bases not only complicates the enemy's attack problem, but allows us to attain a faster launch rate for our own forces. The advantages of *hardening* and *mobility* are, I am certain, evident to all of you. The key to the whole reaction capability is, however, warning—and warning and communications are synonymous.

The two types of warning with which we are primarily concerned are strategic and tactical. As you

know, strategic warning consists primarily of intelligence information of enemy activities which might indicate the imminence of an attack. Its sources are worldwide. To be useful, this information must be up-to-the-minute and accurate. Therefore, the success of our intelligence efforts depends to a great degree upon rapid and reliable communications.

We have already established an elaborate network to provide tactical warning, which would ordinarily be notification of an incoming attack. Our warning network against manned jet aircraft and air breathing missiles is practically complete at this time. It consists of our Distant Early Warning (DEW) Line, which runs across the northern fringe of the North American continent—with extensions continuing on to join the NATO system in the East and as far as Midway Island on the Pacific side—plus the Mid-Canada Line and the Pine Tree Line. Other North American radars, early warning picket ships, airborne early warning and control aircraft and Texas Towers complete this system—a vast and intricate network whose optimum effectiveness depends upon rapid and reliable communications.

The coming of intercontinental ballistic missiles makes our warning and defense problems even more complex. The most obvious impact is the drastically reduced warning which will be available to us in case of a missile attack. Three Ballistic Missile Early Warning Sites (BMEWS) are presently programmed, and one is already under construction. The purpose of these sites is to give this country as much warning as possible of a missile attack. This warning will be 15 or 20 minutes at best. When minutes spell the difference between life or death of a nation, every second—in fact, every micro-second—counts. Again, communications is the key, and again, it must be accurate, rapid and reliable —there is absolutely no margin for error.

Within minutes of warning of an attack both our defensive and offensive forces will react. Our manned interceptors and surface-to-air missiles will be launched to intercept and attack incoming enemy forces as far away from their destination as possible. At the same time substantial numbers of our strategic striking force will be on their way to the target. Control is the key to the success of this operation and control is only as good as the communications system through which it operates. Control of the air battle—that is the protection of our own out-going forces and the direction of our defensive weapons against incoming targets—is mandatory for successful results.

This warning must also be transmitted immediately to all of our commands and bases world-wide so our overseas and "reflex" forces can be launched toward their targets with no delay. It must be flashed to the various headquarters, and then sent to operational commands who in turn must relay it down to the many dispersed units under their control. Speed is essential—and there must be no errors. If communications break down—or are inadequate to begin with—irreparable damage could result.

Our day-to-day peace time communication requirements for operating a supersonic, long range, widely dispersed Air Force also have reached a new and unbelievable high. For example, all of Air Materiel Command's Air Materiel Areas, depots and logistic control groups are linked together in a high speed communication network for the purpose of providing the most rapid service available in supplying our operational units. Up-to-the-minute operational reporting is also accomplished through a worldwide communication net. Control and surveillance of our daily flying operations require the most modern type of communication equipment between aircraft and ground facilities.

Many other examples of the vital day-to-day applications of communications could be cited, but I am certain that most of you here are as familiar with them as I am. The implications are obvious. The drastic compression of time and distance has emphasized above all the critical need for centralized control of our operations. This control must be based upon the most accurate information available, rapidly transmitted, and properly collated and displayed. Only an elaborate and complex system of the most modern communications facilities will meet these requirements.

We are making progress in all of these areas, but we have not by any means reached the point where we can say that our communications are adequate. It would be more accurate to state that our communications are continually lagging behind the needs of our rapidly expanding operational requirements. There is a very vital need for increased effort, for new and radical thinking in this area, and for rapid development of new equipment which can meet our growing demands. I would like to mention just a few examples of the type of improvements which are required to match our communications to the needs and tempo of our defense systems: range extension of our tropospheric scatter systems, and more extensive channelization of these systems; improved reliability and security in our cryptographic devices for voice, data and pictures; increased speed for record type communications—our teletypes must operate at rates of pages per minute rather than words per minute; last, but certainly one of the more critical requirements, a reliable worldwide voice capability.

The communications satellite is an encouraging possibility, and other new transmission media show promise of helping us overcome some of our present deficiencies. There are still other areas where breakthroughs are taking place—or will take place in the near future. It is up to us to capitalize on these breakthroughs and to convert them rapidly into useful communications systems.

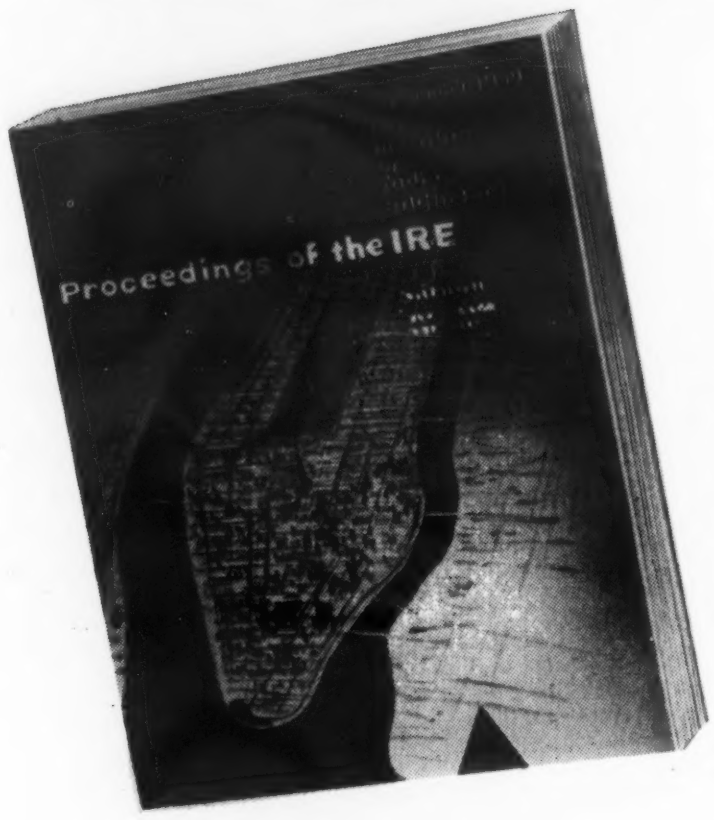
It is obvious that communications in today's defense activities can no longer be considered merely a service. Communication is an integral part of the weapon systems which we develop and employ, and an essential element in the proper functioning of the command structure that controls and launches these systems. The communications equipment which we develop must be tailored to meet the exact requirements of our specific tasks. Common items—those which satisfy some of the needs of all of the services, but do not meet the full requirements of any service—are not the answer. Requirements for Air Force communication equipment—and I am sure that this is equally true with the Army and the Navy—must be met with no compromises. Our equipment must meet the full demands of our military systems and must be completely responsive to the needs of the men who control and operate these systems.

I am certain that most of you remember that time-worn saying, "There is always somebody who doesn't get the word." Failure to get the word, until very recently, has seldom been completely disastrous. Today, our whole defense—our national security —depends upon our ability to get the word—and to get it in time to act. The only sure way of getting the word is an up-to-the-minute system of rapid, reliable and secure communications. In this day and age, communications could prove to be the "Achilles heel" of our nation's defenses. It is up to all of us to make sure this does not happen.

As Comprehensive A Review of

INFRARED

as Security Restrictions Will Allow!



The turning point in the practical application of infrared to military prob lems was during World War II when the Allies discovered the Germa Army was using infrared for secret signaling between infantry troops, fo the surveillance of Russian tanks supposedly secure in the darkness, an for the detection of Allied night bombers which confused radars by the us of chaff. The turning point for the commercial application of infrare came about the same time when the American synthetic rubber progra required rapid analysis of the C_4 fraction in butadiene production. Sinc this could best be achieved through infrared spectroscopy, commerci infrared spectrophotometers for chemical analysis began to appea in 1943.

Today, despite great advancements in the application of infrared to mil tary and commercial uses, it appears to be only on the threshold of its fu realization. That's what makes infrared such an exciting and challengin topic to investigate.

SEPTEMBER PROCEEDINGS OF THE IRE EXPLORES ENTIRE INFRARED FIELD

This special INFRARED ISSUE of the Proceedings of the IRE is the first unclassified American publication to bring together in one place the bulk of the basic information on infrared physics and technology. The material is current, authentic, and much of it recently declassified. It was prepared under the auspices of the Infrared Information Symposia (IRIS), an organization sponsored by the office of Naval Research and under joint-service direction.

This comprehensive review of a rapidly growing science-infrared—is only one of the many services offered mem bers of the IRE. Non-members of the Institute of Radi Engineers, however, are invited to reserve a copy of thi vital issue by returning the coupon below, today.

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A History of Infrared, by Dr. Warren N. Arnquist and Dr. E. Scott Barr.

The Physics of Infrared, by Dr. Lewis E. Larmore.

The Infrared System, by Dr. Sidney Passman.

Applications, by Dr. Paul J. Ovrebo and Dr. R. Bowling Barnes.

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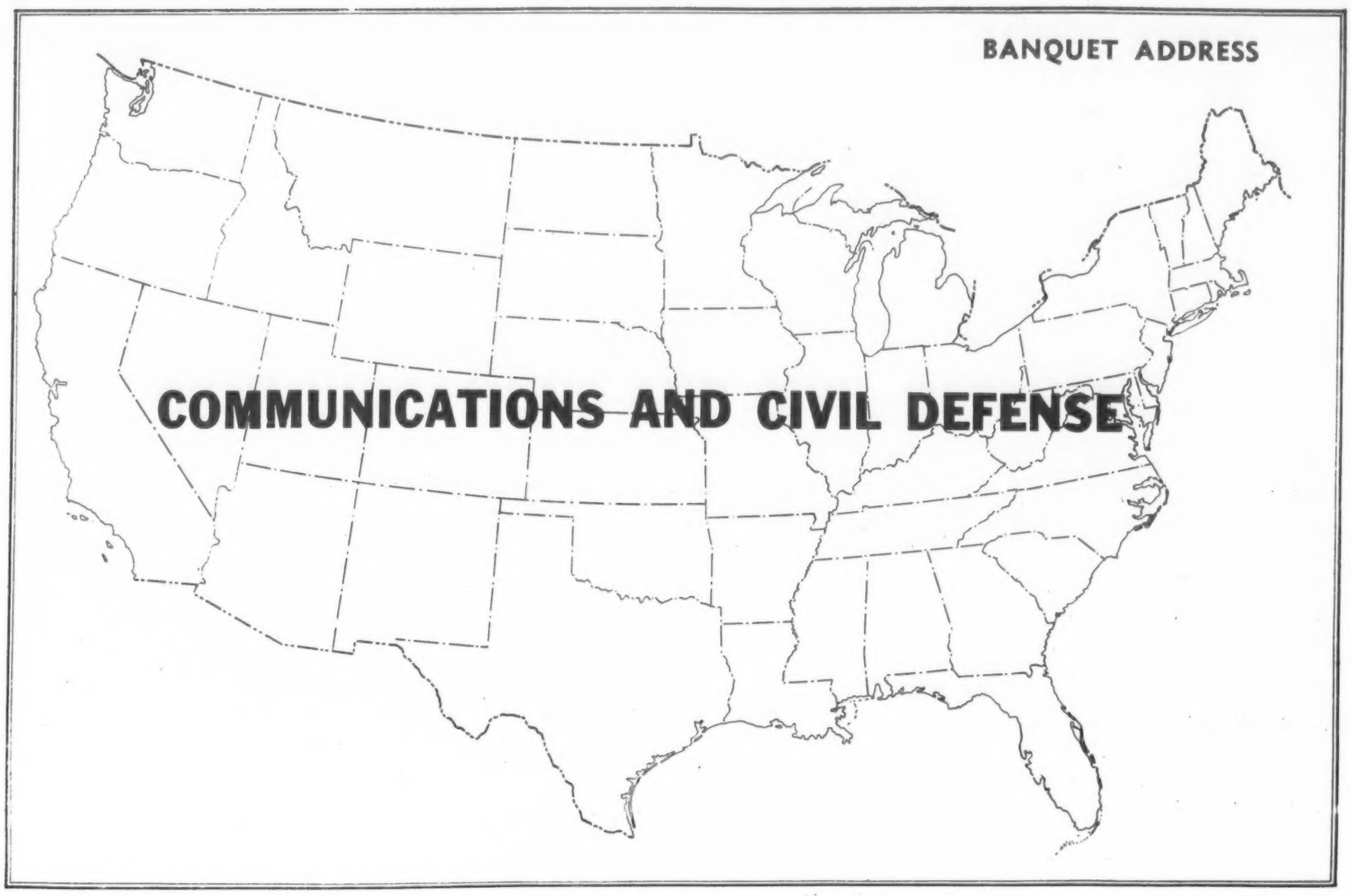

COMMUNICATIONS AND CIVIL DEFENSE

by GOVERNOR LEO A. HOEGH
Director of Civil and Defense Mobilization

IT IS ALWAYS gratifying to see industrial leaders and military leaders working so closely together. The electronics and communications industries are of vital importance to our normal pattern of living, and their importance would be multiplied many-fold in case of national emergency.

I will not dwell at length on the importance of the industries represented here tonight. It would hardly be appropriate for me to tell you how important you are.

Communications had their first true meaning for me when I served with the Armed Forces during World War II. As a Unit Commander and as the Operations Officer of an infantry division, I learned that coordination. control and direction were musts. Unless you had good communications, you lost that coordination. control and direction—and you were in trouble. With it, you had success.

Let me give you an example. When the 1st Army was driving for the Roer River in November and December 1944—the key terrain within the 7th Corps Zone was to our division's front. It was a stone fortress, a heavily reinforced village, perched on top of a hill, commanding the approaches to the Roer River. To advance without first capturing it would be suicide. To seize it in daylight would be suicide. To attack it at night required superior coordination and control. To assure a successful night attack, we directed the lead company to strengthen its communications capability by carrying two additional 300 radios.

In the black of night, 140 men of the lead company rushed the objective. All hell broke loose, but 32 men with *one* 300 radio had reached it—they held one stone house on the edge of the village. They were completely surrounded, reinforcements could not reach them. An intercepted message from General Jodel to his Commander read: "Hold Lucherberg at all costs. Immediately repel any penetration."

We were as determined to hold our position as they were in retaking it. However, the odds were against us. The lieutenant and his 31 men were fighting tenaciously, but soon they would have been overcome by sheer numbers except for one thing—the 300 radio. Through it the lieutenant had control of 18 battalions of artillery. Time after time he placed their fire on his position, each time repelling severe German counterattacks. Eight hours later, reinforcements reached our foothold—the defense was broken—the commanding ground was ours. General "Lightning Joe" Collins, 7th Corps Commander, described this operation as one of the finest in the European Theatre. Valiant men, yes, but also superb communications, won this great battle.

A grateful nation depended upon you in the past, and it depends upon you today and tomorrow for this most vital resource—communications.

When it became my job to assist in the non-military defense planning for our country, I knew the importance of your industry to both our peacetime living and our national security.

The President's Reorganization Plan No. 1 of 1958 made the President responsible for the total defense

of the country, military and non-military. He has allocated to the Office of Civil and Defense Mobilization the non-military portion of that responsibility.

Most of you are concerned primarily with the military defenses of our country. No reasonable person would undersell or discount the importance of your task. It should be noted, however, that the complement to your job is the creation of sound non-military defenses in our country.

Civil defense is a relatively new concept in American life. There was a time, decades ago, when distance was an adequate insulation from the heat of war for the people of our nation. The Revolutionary and Civil Wars were tragic reminders of the privations that occur when the battles are fought over the hills and meadows of your own land. It was a time of national sorrow when we sent our troops away in 1917 and 1941 and 1950, but there was some comfort in the knowledge that our lands and our homes were safe from the ravages of war.

That period in our history has passed. Distances that were counted in days are now measured in minutes. We have outsped sound and we look to the next barrier. It is possible now to light a cigar in New York and tap it out in Washington. We have made a neighborhood of the world.

The swift strides of science have coupled these achievements with the creation of weapons of city-destroying power.

The lethal fingers of the new weapons can reach out for hundreds of miles through radioactive fallout—bands of tasteless, unfelt and awesomely silent death. The thermonuclear bomb develops heat comparable to that of the sun. The blast is greater than any we had previously known.

For these, and other reasons, civil defense and defense mobilization are today vital parts of the total defense.

Civil defense is the joint responsibility of the Federal, State and local governments. The partnership created by Congressional action last year blends together the leadership of the Federal Government with the experience and capability of action of the State and local governments.

The National Civil Defense and Defense Mobilization Plan was promulgated by the President last October. This is the first time that civil defense responsibility has been spelled out in detail. In it, the mission of Federal, State and local governments, of specific groups and organizations, and of individuals themselves has been set forth. Civil defense responsibility, from the highest official to the average individual, is established in concrete terms.

It is abundantly evident that in case of attack we will need the leadership of government on all levels. An integral part of the preparation for attack is the insurance that government will continue to operate. The Federal Government and the various States, working hand in hand, are developing continuity of government statutes.

Succession in depth for all key officials; preparing and equipping alternate sites from which government can continue in an emergency; making specific assignments for emergency use of all personnel and resources: these are a part of the typical continuity of government statutes. Legislation designed to meet this end has been introduced in 40 State legislatures and passed in 27 legislatures at the present time.

The Frankenstein of modern warfare, radioactive fallout, makes special preparation necessary. Because of its nature, detection, measurement and reporting is a serious problem. Special equipment and trained personnel are necessary. The Federal Government, through OCDM, has embarked on a radiological defense program. By July 1, approximately one million students in high school classes all over the nation will have received radiological defense instructions. We have more than 500 federally-operated fixed monitoring stations now, and the total will reach 1000 by next January 1. In the States we have over 14,000. With State and local governments, by July 1, 1963, we will have 150,000 fixed monitoring stations spread throughout this nation, ready and capable to detect, measure and report on radiation fallout.

One of the basic truths in the concept of civil defense is this: the greater the shelter available following nuclear attack, the greater the chance for survival. The President has approved the first National Shelter Policy. Under that Policy, the Federal Government is responsible for an intense educational program, for sampling surveys of existing structures to determine shelter capability, for accelerated shelter research, for the construction of a limited number of prototype shelters and for the incorporation of shelter in Federal buildings.

Our warning system is good, and we are constantly improving it. Today, we can notify 276 critical points of an impending attack within 1 seconds — this is being extended t cover an additional 100 critical point this coming fiscal year.

Our communications system i good, and we are constantly improv ing it. Today, we have telephone an teletype — we are bypassing critica target cities. We are backing it u with radio to our regions and th States.

Forty-six States and 243 metropoli tan areas have completed their sur vival plans covering over 98% of the people. These are being converted into action plans.

I certainly do not imply that the goal of effective non-military defense has been achieved. We have come a long way down the road of civil defense preparedness. We have a long way still to go — every American needs to know the 5 fundamental steps for civil defense preparedness:

Learn:

1. Warning signals and what they mean.
2. Your community plan for emergency action.
3. Protection from radioactive fallout.
4. First aid and home emergency preparedness.
5. Use of Conelrad—640 or 1240 for Official directions.

The wide range of the problem of building a strong non-military defense capability to supplement and complement the strength of our Armed Forces is demonstrated in your own field.

For example, during World War II, Federal Government messages over Western Union facilities reached a war peak in 1943, when 15.5 million messages were handled. In World War II, the Bell System alone furnished to the government about 400,000 miles of inter-city leased circuits and 2,600 teletypewriter stations.

You are well aware that the government leases entire communication networks from the common carriers. As far back as 1949 government agencies were obtaining the use of almost a half million miles of wire networks through lease arrangements with the common carriers. The military services alone use over 150,000 miles of leased wire lines. Other large users are the Weather Bureau, The Federal Aviation Agency, The Veterans Administration and the General Services Administration.

Although the government — primarily the Army, Navy and Air Force —owns world-wide radio networks, we are dependent on commercial

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ST, 1959

The Marines are landing with COLLINS SSB COMMUNICATION

On February 16, 1959, Collins received a contract from the Marine Corps for production quantities of AN/TRC-75Transceivers. Sixty-eight days later the first of these jeep mounted, high frequency communication stations were on their way to Quantico, Va. Modular design of similar Collins equipment speeded adaptation to Marine Corps requirements – saved research and development time and expense.

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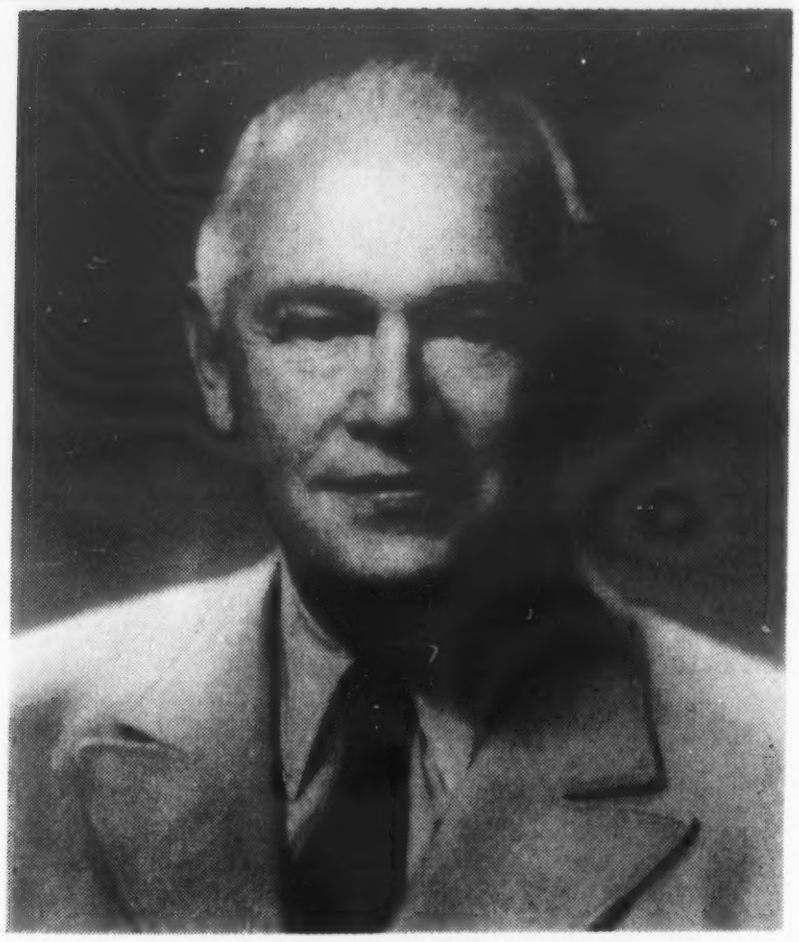


W. J. BAIRD
Colonel, U. S. Army, Ret.
General Manager & Editor

THE APPOINTMENT OF Colonel W. J. Baird, USA(Ret.) as the new General Manager of the Armed Forces Communications and Electronics Association was announced by the Board of Directors of AFCEA during the Association's 13th Annual Convention in Washington, D. C.

Colonel Baird will take on the added administrative duties in this newly created position in addition to those of his present position as Editor of the Association journal, SIGNAL. With his extensive background in military-industry relations, Colonel Baird has made many contributions to SIGNAL during his Editorship.

Colonel Baird was commissioned a second lieutenant in 1926 following his graduation from West Point, where he was a cadet officer and outstanding athlete. On his first duty assignment, in addition to his position as company commander, he was Post Signal Officer of one of the largest military commands. After serving in various troop units and staff assignments in the U. S. and Hawaii, and graduating from the Infantry School, he was assigned as Professor of Military Science and Tactics at Valley Forge Military Academy and as Aide to the Governor of Pennsylvania.

After numerous peacetime assignments, serving in the Canal Zone, at Fort Benning, Georgia, Fort Sam Houston, Texas, and with the Washington, D. C. Provisional Brigade in command and staff positions, Colonel Baird served as Chief of the Military Mission to the USSR and on the War Department General Staff (1941-1943).

He received commendation for his outstanding work on the first and second Churchill-Stalin-Roosevelt protocols for war supplies and as chief of the International Aid Division was responsible for 51 allied nations in the procurement and requirement field, representing these countries before the Munitions Board, Joint and Combined Chiefs of Staff and the Lend-Lease Administration. Upon his graduation from the Command and General Staff School at Fort Leavenworth, Kansas, he joined its faculty serving as Instructor, Dean of Men and Director of Instructor Training and a member of the academic board.

In 1948, Colonel Baird went to Korea, where he served as Regimental Commander of the 31st Infantry and later as Commanding Officer of the Korean Base Command, including U. S. Communications organizations. He next saw service at the Headquarters of the U. S. Army, Pacific as assistant commander of the South Sector Command. After studying at the Industrial College of the Armed Forces, Colonel Baird became Chief, Logistics and Materiel Planners on the Standing Group, North Atlantic Treaty Organization (NATO). As such, he advised the U. S. Delegation to NATO Conferences at Ottowa, Rome, Lisbon and Paris. In his NATO position, he worked with international planners of all NATO countries in Europe and SHAPE on the production, procurement and economic problems of NATO and made many contributions to the logistics involved on the National and International level.

In 1954 he returned to the Industrial College of the Armed Forces as Vice Deputy Commandant of the Education Division and in 1955 was appointed Assistant Commandant (Administration), in which capacity he served until his retirement in July 1956. Upon Colonel Baird's retirement he was selected and appointed as a member of the College Board of Advisors.

He is a member of the Board of Governors of the West Point Society of Washington, D. C., having been instrumental in its foundation. He served as its Secretary for four years. He is an active member of the Golf Course Superintendents Association and past president of the Heart of America Golf Course Association. As a result of his wartime service, he received several Certificates of Commendation and was awarded the Legion of Merit and the French Legion of Honor as well as the Brazilian Military Order of Merit and the Order of Polonia Restituda.

He also holds the following medals: American Campaign, American Theatre, Asiatic Theatre, World War II Victory, Korean Occupation, National Defense Service, and Department of Defense ID. He was President and Chairman of the Board of the Army Cooperative Fire Association, Leavenworth, Kansas, (presently serving as an advisor) and was responsible for modernization of the association's business and strong financial development.

He is the author of "Psychology of Teaching," "Methods of Teaching," "Psychology of Public Speaking," "Psychology of Questioning" and "Visual and Audio." He is a member of Pi Gamma Mu, Sigma Nu, American Ordnance Association, Association of the United States Army, AFCEA, several fraternal organizations and is a member of the Army and Navy Club of Washington, D. C.

some aspects of research and development today

By J. CARLTON WARD, JR.
President, Vitro Corporation of America

I HAVE BEEN asked to give my views on research and development and, insofar as practicable, production and procurement. This covers the water front. Obviously I will have to limit myself to some aspects of this broad field and it seems appropriate to roughly define it, briefly trace its history, see where it is going and examine what significance this has for us.

It has been said that science is differentiated from all other areas of knowledge by certain fundamental characteristics. I believe it was Lord Kelvin who stated that if you cannot measure it, it is not scientific. Dr. James B. Conant in his *Messenger* lecture at Yale took some pains to point out that science started with hypothesis which was based on observation and then depended upon experimental verification before it could become accepted knowledge.

One of the subtle characteristics of scientific knowledge is that it permits extrapolation within reasonable limits. This is because many scientific phenomena are linear although in the electronics sciences, as an example, we find many instances of non-linearity. This is particularly true of the new era of magneto-hydrodynamics and of plasma physics.

In everyday language we can say that science develops into accepted knowledge through research and development. It is obvious that research is quite different from development but no one knows better than the Armed Forces that one cannot readily find where research leaves off and development begins. Research in turn is often divided into theoretical or fundamental or basic research and its counterpart, applied research. Here again it is almost impossible to detect a fine line of division between these defined areas.

Thus, physicists are often labeled theoretical physicists or applied physicists. Yet I venture to say that at times a physicist does wear both hats.

This is neither the time nor the place to do more than point out that procurement contract administration can become very much involved in these concepts and that likewise they present real problems in procurement administration. A characteristic of theoretical research is that it produces no hardware and at times can lead to no conclusion. Often its most valuable contribution is in determining what is not fact as opposed to what is.

Thus, a sum of money spent for a report can be, and often is, an excellent investment, although I must say it can present a problem in accounting for funds spent, certainly in connection with congressional investigations. Dr. Vannevar Bush stated in his authoritative book on research and development in World War II, *Modern Arms and Free Men*, that we have used up over fifty years of knowledge from theoretical research in five years of war.

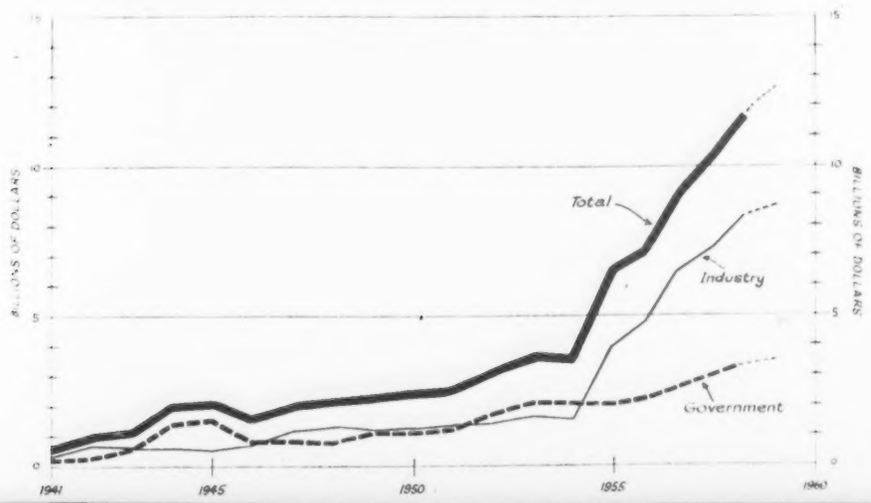
I believe the Office of Naval Research was the first defense agency to attempt to contract with universities in this field of fundamental scientific research during the postwar period,

(*Continued on page* 22)

Industrial Luncheon Address

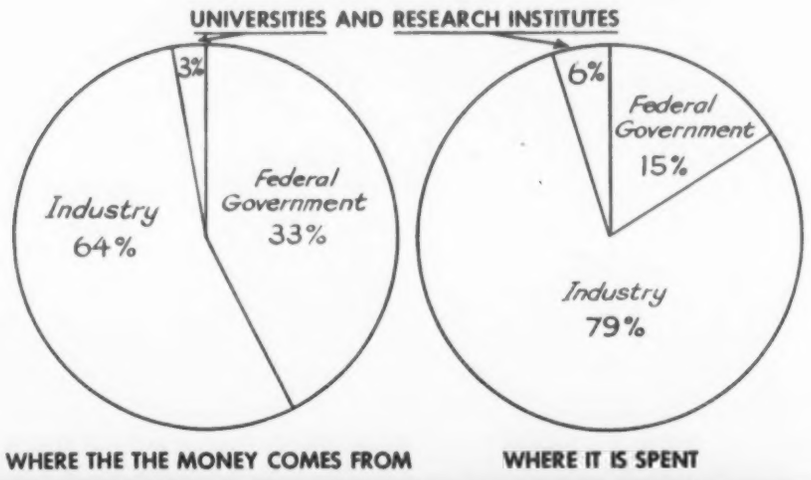
GROWTH OF RESEARCH IN THE UNITED STATES

Based on Research and Development Board and McGraw-Hill estimates



SPENDING FOR RESEARCH & DEVELOPMENT

FOR THE YEAR 1957



FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT

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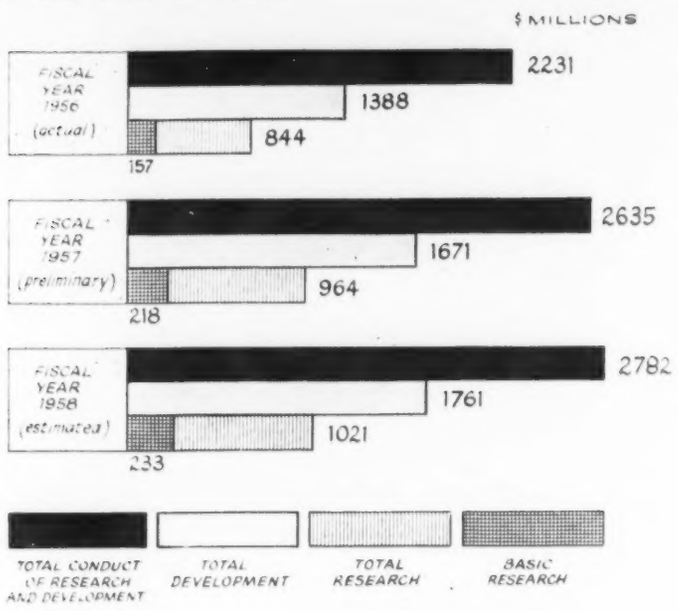
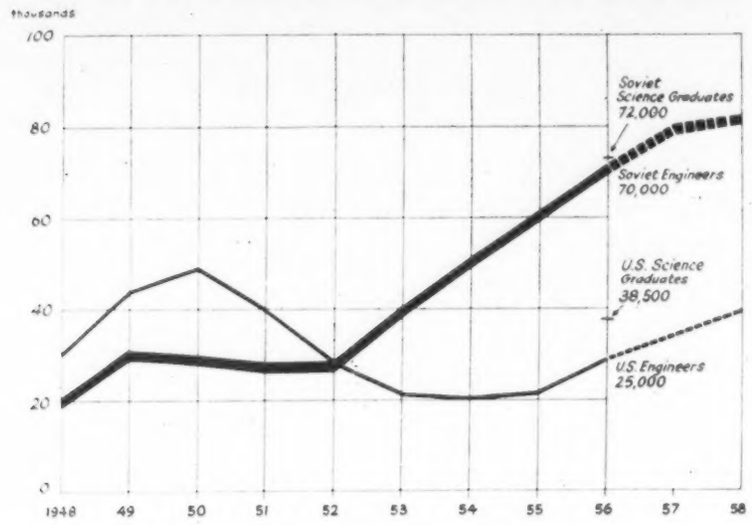


ENGINEERING GRADUATES IN THE U.S. AND RUSSIA



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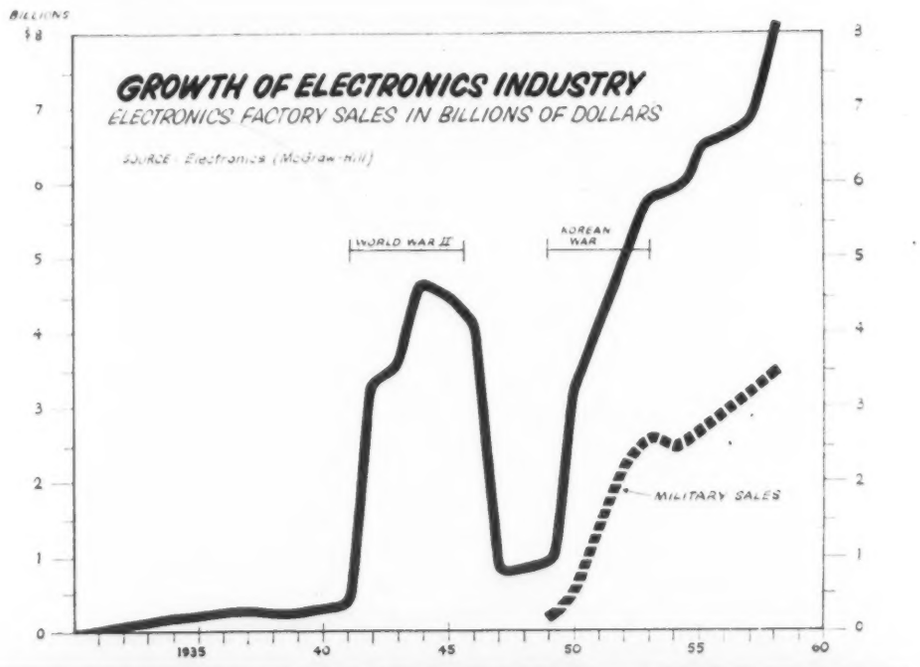
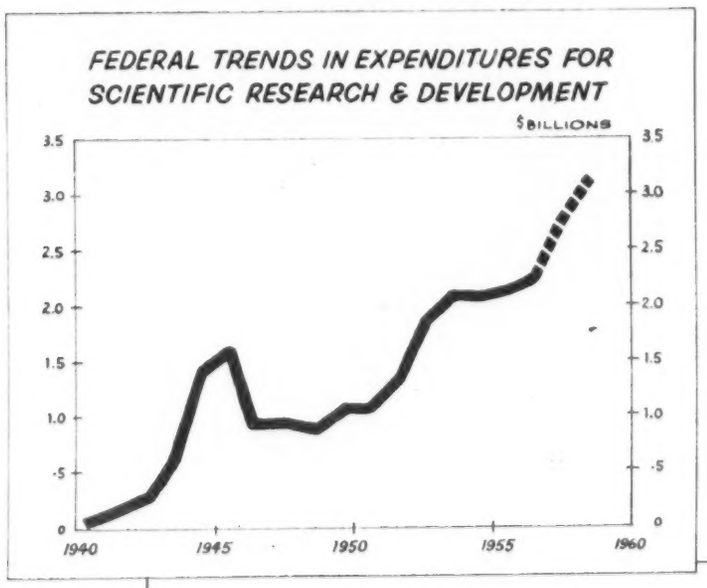
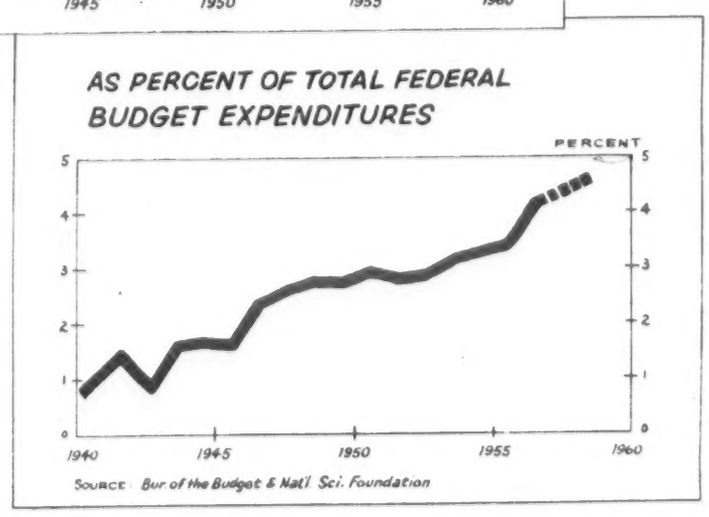
Source: McGraw-Hill, 1957







thus performing a function of incalculable value, only to find that it was subject to great congressional "eyebrow lifting" under the guise of economy. It was followed by an attempt to create a procurement procedure that would more clearly establish the *quid pro quo* for such contracts with the result that they became less effective and useful.

Another aspect of this problem is that when the money pinch becomes extreme, hardware seemingly is favored. In my mind this phenomenon is very much like a long pipeline in which deliveries continue long after the original supply is shut off. The consequences of such a circumstance are clear. I believe today the services understand and recognize the problem that between Sputnik I and the resulting Space Agency theoretical science has been made more respectable.

Within the last few weeks one of this country's most distinguished astronomers and astro-physicists spent some time telling about how he and his colleagues have been discovered and added, "The supply of us is so limited that the scramble for our services has deteriorated to an unethical basis." The spectacle of industry hiring distinguished teaching professors away from their campuses is another application of the concept of the pipeline analogy and would not be permitted by our great and ruthless competitor in international affairs—Russia. While some of these distinguished professors make the transition from the academic background to industry in a painless, if not pleasant, manner, others find it a painful and unfortunate experience for them and for the country, and certainly for our defense and security. Military procurement should be very conscious that it can be the means both directly and indirectly of doing incalculable damage to our educational process and our supply of scientists and engineers in the future.

It is well known and thoroughly documented that Russia today is training more engineers and more scientists in the fields of interest to national defense than are we and our allies combined. Furthermore, there is ample evidence to support the fact that they are equal to us in quality although more specialized, and furthermore that their entire educational system, particularly through the secondary schooling, is more serious, is more basic and is more advanced than our own.

Now perhaps we should also think about our engineers. These gentlemen are often confused with scientists and vice versa although perhaps this is now much less frequent. Nevertheless, we should keep clearly in mind that they are quite different and that their function is very different. The scientist, whether theoretical or applied, has been trained to expand man's knowledge for knowledge's sake. He may at times design and build apparatus for his own use and demonstrate the proof of his theories, but the engineer is schooled along very different lines and for different objectives. He must have capabilities of acquainting himself with new scientific knowledge and its probable uses and then adapting it to the purposes of mankind.

It has been said, as an example, that the engineered design of a bridge should be scientific, yet the purpose for which the bridge is built and which determines its design is entirely economic and hence social. It is not enough to build a bridge unless one knows the kind of traffic that will go over it, the way in which the traffic will go over it and how to conduct the traffic in the most economical manner not only for today but throughout the useful life of the bridge. This involves forecasts of population distribution, kinds and size of future vehicles, volume of traffic, traffic patterns, and traffic characteristics as to speed, axle loads, bulk dimensional limitations, and many others too numerous to mention. With these the engineer must deal and many of his decisions must be intuitive even though his calculation of stress and strain on each bridge member must be based upon the scientific knowledge of materials and their forces.

Our engineer must be a practicing economist. In the field of production the engineer again departs from pure science into the broad fields of social considerations of labor economies, labor management, and money economics. This field is often called that of the social sciences. Social it is—science it is not. The engineer must be equally at home in dealing with it as with his scientific premises.

Procurement procedure often becomes so delimited and stilted that it fails to consider efficiency incentives and instead, sacrifices its primary objectives for detailed bookkeeping and money accountability. Probably no single industry, in a greater degree than that of the communications and electronics industry, should understand this. Very often procurement is so administered that it stimulates the production of inferior articles by its very inflexibility and its lack of an understanding of the many considerations that we have defined. Let us look at a brief history of research and development and its present trends by means of the following charts:

Very few realize the history of research in the United States. Presumably it began at the turn of the century with a laboratory of seven scientists at Schenectady, New York, and this was the first commercial research laboratory. Now I don't want to get involved in the theory of what is research and invention except to say that invention is a personalized process which you can sort of picture in the image of Thomas Edison. On the other hand research is a team effort with men of discipline who have knowledge and depth in certain fields and have joined together as a team to attack a common objective. Under that sort of definition the research began in 1903. It did not get anywhere very fast until World War I. If you will look on the left of chart I, you will pick up a period of the 30's; those little marks on the ordinates are in billions of dollars. In World War I the Germans were doing most of the research in the industrial countries of the world and we had none. Our military establishment had to fight a war with foreign goods and ordnance and supplies. This caused the first realization in the U.S. of the role of research. It staggered through the depression 30's and as we entered World War II it amounted to 300 million dollars a year for the whole country — this includes government and industry. Now, if you will look at the first slight hump on that chart, that's World War II, and research went up in a year and a half from a 300 million level to a billion 100 million level. You see qualitatively this is an enormous jump. You'll notice a sort of decline after World War II and then you see a kind of a movement along until Korea when again the government had its second shot and research was highly stimulated. From there on, we have been taking off in an almost azimuthal attitude toward "out-there yonder." Research today is in the order of nine to ten billion dollars-a-year and the National Science Foundation is predicting it as a 15 billion-dollar-a-year occupation. Plotting that as an economist against the gross national product (GNP) of the U.S. and against other civilized countries of the world you will find it probably represents more money than all the rest of the world is devoting to research. However, it includes development, and as you all know many development expenses are hidden away

(*Continued on page 41*)

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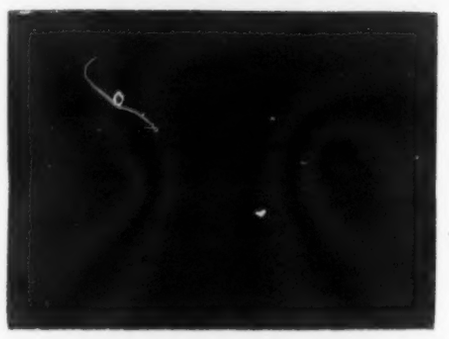
PANEL DISCUSSIONS

Presenting in this issue the first of a series of subjects introduced by the panel moderators below.

***Modern Concepts of Space Communications*.....25**

***Scientific Applications of Photography*.....34**



***Educational Programs in Electronics*..... .....48**

***Military and Industrial Aspects of R&D Management*.....50**

***Optimum Combination of Man and Machine for Maximum Reliability in Space Travel*.....56**

A comprehensive coverage of timely subjects relating to the state of the art of communications, electronics and photography was revealed in the panel discussions presented at the 1959 June AFCEA Convention. An interested audience was enlightened by these discussions which were presented by select and outstanding spokesmen representing industry and the military. The following eight articles are the first in a series to be published by SIGNAL. Others will follow in subsequent issues of the magazine.

PANEL: ***Modern Concepts of Space Communications***

SPEAKER: ***Dr. Samuel B. Batdorf, Advanced Research Projects Agency***

THE IMPORTANCE of communications in modern warfare is difficult to overstate. Imminence or commencement of hostilities in any part of the world should be relayed to Washington immediately. The forces of all three services are deployed all over the globe and in spite of this they must be subject to continual control through the normal chain of command. Such objectives can only be accomplished by rapid, reliable and secure communications in considerable volume.

As was pointed out by previous speakers, present long-range radio links are in the HF region or lower frequency and are therefore severely limited in the number of channels available, and in addition suffer from unreliability as a result of ionospheric disturbances and radio noise. Repeaters placed on satellites can provide an operational break-through and eliminate these difficulties because of their capacity to convert the normally short range line-of-sight microwave communication into long range communications. In general, passive satellites offer the substantial advantage of reliability and a large number of links per satellite at the expense of a rather large ground installation in order to get an adequate communication capacity per link. Active repeaters give substantially greater communication capability in a given link for a given weight in orbit and this advantage increases rapidly with increasing distance between stations. Because of these factors and also because it is much easier to harden the relatively small antennas which can be used in conjunction with active repeaters, military programs are based primarily on the use of active repeaters.

Active repeaters are two types—the delayed repeater and the instantaneous repeater. An elementary demonstration of the former was provided recently in Project Score, when the President's Christmas greetings were broadcast from a tape recorder in an orbiting Atlas.

The concept of the delayed repeater works this way. A satellite picks up the message from Station A while passing over it, stores it on a tape recorder and carries it to Station B where it is delivered. Simultaneously a message is picked up for delivery at a subsequent station. Messages are thus physically carried around the world. By these means a message can be carried halfway around the world in an hour or less.

Now let us consider the trajectory of a satellite in an inclined orbit. In the inclined orbit the satellite pursues a sort of sinusoidal path, wandering back and forth across the equator with successive passes displaced by a matter of a couple of thousand miles. As a result of this, the situation is likely to arise that for several turns about the earth in a row the satellite will pass too far south to communicate with a given station in the northern hemisphere. In an equatorial orbit, if a station is within range at all it can be reached on every pass. For this reason an equatorial orbit is preferable even though there is a penalty in payload which must be tolerated in order to achieve an equatorial orbit from a launching site in the northern hemisphere.

At an altitude of 1200 miles communication can be established with stations as far as 30° north or south of the equator. As altitude increases a point is reached at which it is no longer desirable to store the message; rather an instantaneous repeater should be used during the period in which the two ground stations are simultaneously in view of the satellite.

An equatorial orbit at an altitude of approximately 22,000 statute miles has the unique property that the satellite will have a period of revolution equal to the period of rotation of the earth, namely 24 hours, so that it appears to be poised above a given spot above the earth's equator. The 24-hour orbit has a number of important advantages for communication satellites. It eliminates the need for tracking antennas, for computation of orbits, and for programming the routing of messages. A system of three such satellites equally spaced could provide instantaneous communication around the earth. At this altitude almost half the surface of the earth is visible from a single satellite and one station in the area can talk to any other station in the area with the aid of that satellite alone. In order to communicate with the station on the far side of the earth it is necessary to go through three repeaters, two on satellites and one in the overlap region of the earth served by both satellites. It would, of course, be more direct to use inter-satellite communication to converse with points on the opposite side

(*Continued on page* 33)

Upper left: AFCEA Director George Bailey congratulates Donald K. de Nuef, Vice President, Press Wireless, Inc., the 3000th registrant. Upper right: Show Manager W. C. Copp congratulates Captain M. Messer, NSA, the 4000th registrant. Left center: Hospitality Chairman Admiral Murrey Royar, National Company, escorts Assistant Secretary of the Army, Logistics, Mr. Courtney Johnson, through the exhibit area.

Above: Retired Chief Signal Officer George Back and a group of friends at Station K4NAA/3: "And I said to him . . ." Lower left: George Bailey, noted Eastern "ham" operator, seated at the controls of the station. Lower right: From the West Coast Comdr. Ray Meyers sends a message, while Donald Parris, BDSA, stands by for his turn.

Photos by USAPS

ANOTHER NATIONWIDE TRIBUTE

by Alex Dreier

to the armed forces communications & electronics association

ONE SHORT YESTERDAY ago—perhaps 25-thousand years by man's meager calculations, but not even a drop in the ocean of infinity—a man with an idea picked up a crude implement and began communicating with his fellow man by painfully scratching a picture on the wall of a cave.

He did so—because he wanted to make a permanent contribution to the science of communication — though he didn't know even one of the words in that sentence.

Today another man with another idea faces another wall — another challenge. Perhaps it is called the problem of safely returning a man in orbit to earth or extracting and identifying a mysterious chemical from a particularly complex solution, but the wall is the same. Its name is ignorance and its enemies are education, patience, courage and progress.

The men who comprise the Armed Forces Communications and Electronics Association, the AFCEA, are men who face such walls each day. And thanks to the close cooperation between American industry and leaders of our Armed Forces and its diverse branches, the walls go tumbling down.

But technical though that title be, we don't think the secret strength of this unusual industry-military partnership lies in a maze of wires and gadgets and gimmicks, in its telemetry complexes and missile components and photographic phenomena, or its technical papers with built-in intellectual block-busters. This is a story of men striving to make something bigger or smaller—working together in a unique partnership to chart the unknown, to improve what we have and create what we have not, to consider the impossible, to ponder it and toy with the possibility that it doesn't really exist except that ignorance—or lack of knowledge—makes it so.

Electronics, communications, photography—each is a vast story in itself and each facet of each story capable of filling volumes. And so you despair of the over-all story. It's never been written anyway, for the men who know most about it haven't the time for it. Besides, it suffers from a great handicap: it is already done. And in these fast-moving times yesterday is equivalent to a century ago and today but a fleeting archway to the achievements of tomorrow.

Today the men of the AFCEA work with the finest technical equipment ever devised by man; but what they can't find, they can create. And the guiding genius behind their successes is their own basic urge to do better.

To them we owe the vast majority of our scientific and technological advances in the greatest age of invention and exploration yet. Perhaps that sounds like an expanded statement but yet it isn't. For today, man stands before the greatest wall in all history —the wall that separates his feeble footsteps and restricts his limited vision from the infinity of outer space, But that wall can't shut out his mind, and the mind, as always, goes forth first, and charts the way.

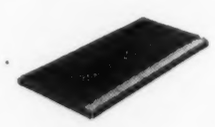
And just as one man once struggled with the wheel, and fire, and the first

(*Continued on page* 61)

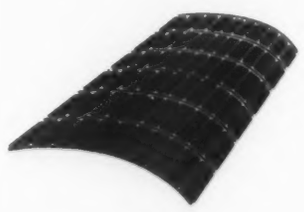
editor's note:

For the second successive year, on Sunday, May 31, 1959, in the broadcast series, "America on the Go," Alex Dreier, national radio and TV commentator, told his nine million listeners, over NBC-Monitor, of the progress and accomplishments in communications, electronics and photography. Mr. Dreier's tribute was a direct tie-in with the AFCEA 13th Annual Convention and contributed substantially to the success of the Convention. We wish to express our profound thanks and appreciation to Mr. Dreier, NBC-Monitor and North American Van Lines, Inc., for making this event possible.

Hoffman solar cells—lasting thousands of years—convert sunlight into electricity to supply power for satellites and space vehicles during entire orbital life.



Highly efficient silicon solar cell converts up to 10% of the light energy striking it into usable electrical power.



Typical solar energy converter. A panel of solar cells of approximately 20 square yards can produce 2,000 watts of electricity.

How much electrical power do you need to run a satellite's transmitter or instrumentation system, or furnish operating power for a manned space station? 5 milliwatts? 2,000 watts? Whatever power you'll need up there—out of reach of conventional energy sources—you'll be able to get . . . direct from the sun!

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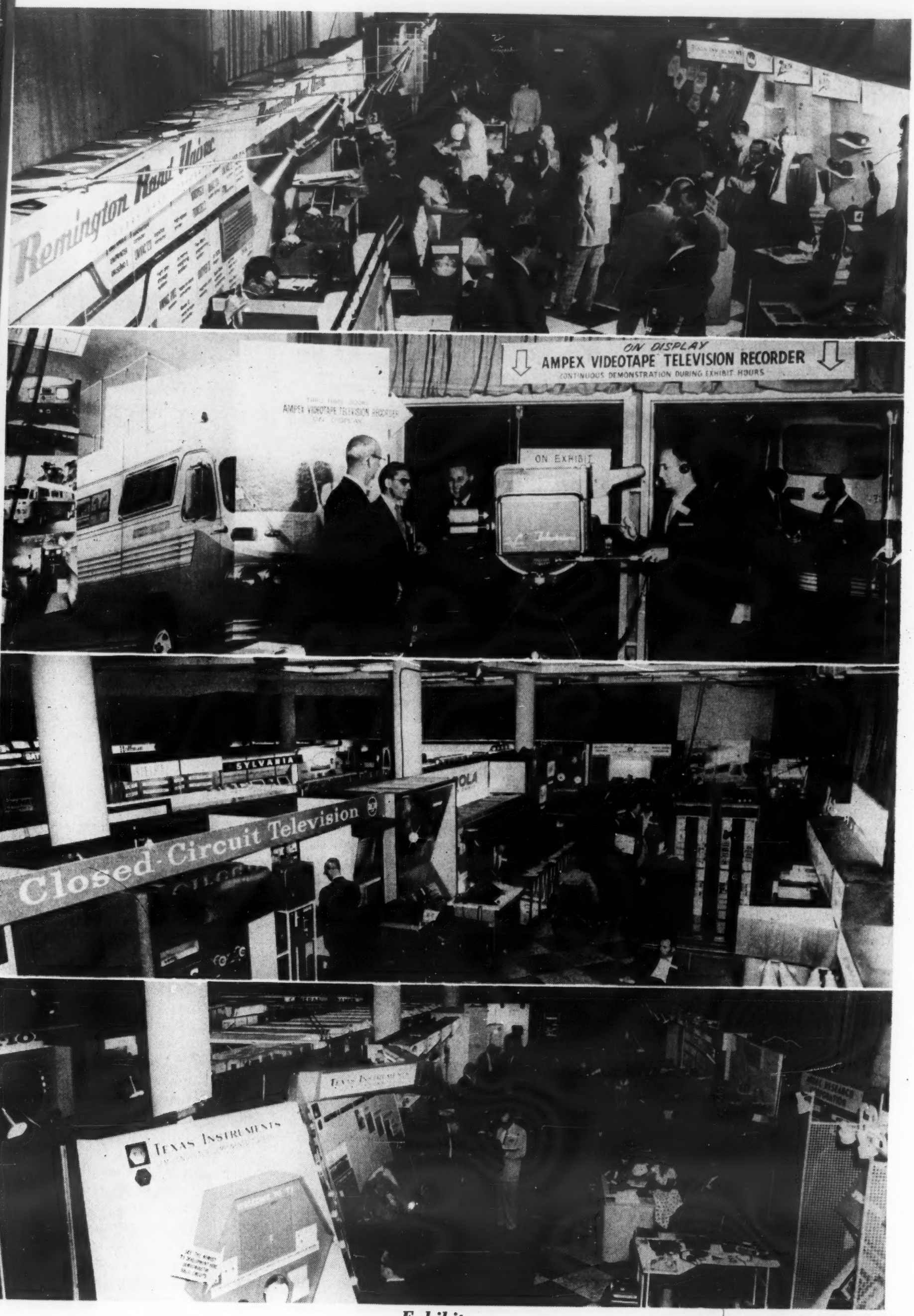
Silicon solar cells—by Hoffman—the key to today's and tomorrow's problem of power in outer space.



Exhibits

Photos by Capitol

man's greatest conquest

spac

by CHARLES GARLA

THE WORDS *radio* and *electronics, space* and *satellites,* have become about as commonplace as *automobile* and *refrigerator,* and more common than *horse* and *buggy.*

Also, more than one kind of ascent is involved in man's conquest of Space: The roles of science and scientists have so ascended that in some nations science ranks higher than religion. There, shrines of the spirit have been superseded by shrines of science.

There is no doubt remaining that this is a new day. In the era of hot peace in the wake of World War II, scientists in many lands have come to wear special 'togas,' put there by an admiring and respectful public that places similar togas of admiration on the military in times of war. This 'attire' is another barrier breeched by scientists and symptomatic of the revolution in the public point of view.

Today's nearly vertical ascent of the scientist in public esteem is as understandable as it is remarkable. Scientists are *today's* magicians and wonder men, and *tomorrow's* Space men. The public, indeed *nations,* have the scientist creating weapons poised for flight that will decimate a continent or destroy civilization at the press of a glowing red-eyed button or red-handled switch.

So we need not ponder why the scientist is regarded with awe: A man is measured by that which he can successfully do.

For example, the capability of destroying civilization: This capability that is claimed for the scientist makes the man who *may* do this and who *can* do it, terrifyingly awesome and almost all-powerful when evaluated by mortal slide rules.

Except for *terminal* blasts, scientists are doing that with which an apprehensive world-public credits them.

Already, man-made objects are orbiting in Space while other objects not yet orbiting are sent charging spaceward farther and farther from this elipsing Earth ball. Literate peoples are identifying scientists with these pioneer probes of Space which in the public mind are forerunners of timetable Space travel. His bold entry into Sp e makes the scientist a sp tacular gure if not a superhun remov from his fellow Earthli and, i he public's estimation, p sessing ower of knowledge unc mon to an and unknown to the man.

Find g Earth too *small* a labo tory, t scientist is bent on conqu ing tha which is not only larger th the 'wo d,' but that which is larg the Un erse, so far as we know n Again ne is large or small by sociati No longer is the scien man-si . Nor even Earth-sized. S entist ter scientist has redu Earth, hich was once our world, a relat y minor planet among ot and la r gyrating Space balls th our ow

Awe me respect for the scien comes a time when the public been p ared to appreciate scient achiev ent. Mass communicati is the ain contributor to this p nomen of public appreciation scienc Incredibly, this appreciati is for t which is beyond reach lay ed tion in many instances, a

for that which is academic or abstract.

For mass appreciation of science to have occurred as it did, science required a common denominator, an amazing and mystifying personal experience, if possible. The miracle embodying these elusive properties happened. Not one, but two miracles: *Radio* was the first, and *television* the second.

Radio was the first personal mass experience with an abstract phenomenon removed from public comprehension. To a large extent, radio still is!

Antennas, or poles and wires like fishing rods with attendant lines catching fish that cannot be seen, caught invisible waves traversing invisible layers in the sky. Although none could see the waves, those who were fishing in living rooms or garages seated under radio's rods and reels could *hear* them.

This was proof. The scientist could be believed. And the scientist's accomplishment with an intangible was pleasurable and popular.

Scientific phenomenon had been reduced to a common experience.

Radio, perhaps more than any other *one* scientific achievement, triggered a scientific awakening in man and boy—educated or not. Imperfect radio equipment and techniques felt the rush of thousands of laymen who, together with scientists, strove to perfect the phenomenon.

The Age of Radio and Radio-Electronics had come. And at that moment in social and scientific history, man was headed for Space.

The blast-off came in less than three generations, the swiftest passing, most developmental and eventful period of man's known time on Earth.

Science is too flushed with its astounding victories for it or its admirers to be able accurately to place its accomplishments in perspective.

Science-in-the-crib is busy trying to conquer Space just as America was once so busy conquering a continent that Americans had little time to wonder who their ancestors were or whence they had come and knew only that they were 'going.'

Americans had little time for history because they were *making* it.

More than a century later—two centuries, three centuries later—Americans are discovering America for the first time and putting the nation into historical perspective. One distant day others shall be able to give balanced perspective to the thresholds on which science stands now, poised for the long flight.

My interpretation of the *meaning* of man's conquest of Space is not yet conventional.

The interpretation:

Earth is a dying planet. Earth began to die when it was born, as do all planets and all things living.

Dying Earth is the platform for man's leap into Living Space.

Space travel means perpetuation of humankind. It means the race's inhabitation of Space, man's relocation and procreation in Space.

It means the emergence of spatial communities and sustenance of spatial civilizations by powers and energy sources now unknown.

It means entire human existences unexposed for *lifetimes* or forever, sheltered and synthetic.

It means the supreme challenge to the adaptability of human genes to new environments consisting of different gases from those of Earth, different proportions of gases, different natural light intensities, different gravities, different climates and different foods.

It means pronounced evolution of the already altered human form.

Most of all, it means survival of the human species elsewhere than on Earth in the regenerative Universe.

It means that from this beginning *now*, mankind will have time to transplant itself in Space for its continuation in the residence of the Universe long after Earth has stopped rotating, stopped orbiting and has wobbled out of existence as mother of the human *sprace*, the future race residing on non-Earth spatial bodies.

Indeed, many new spraces will emerge, each reflecting the races of the distant planet's Earthling pioneers who shall inhabit it and procreate there, and also the environment of the resident planet.

Spraces will not be differentiated by color as on Earth, but by planetary designations and the distinguishing physical contours and features peculiar to a planet's human inhabitants induced by the extremes of local conditions.

In short, it means that this is the *pre*-beginning of the inhabitation of the spatial infinite by descendants of present Earthbound races.

All this, that is, if Earth-bound man does not destroy himself or his capability before he extends his existence to residence in Space with the same power by which he is becoming capable of accomplishing either his self-destruction or his universal self-projection.

That which man conceives can be.

Deductive reasoning propounds that the Universal Will is that man shall survive Earth and inherit the Universe.

Communications & Civil Defense

(*Continued from page* 16)

overseas facilities to round out our needs for international service.

It is readily apparent, therefore, that any pattern of complete defense capability must take into account the communication needs of the country in case of emergency.

The basic authority for the control of telecommunications in an emergency derives from the Communications Act of 1934, as amended. There are two pertinent sections. One provides that the President shall assign radio frequencies to the government stations, and the other authorizes the President during a period of war to establish priority systems for use by all carriers to assist in meeting national communication needs.

The President has arranged for the peacetime delegation of these wartime powers. Through Executive Order the Director of OCDM will have authority to assign radio frequencies and to prescribe the application of priority systems only during the continuance of a war in which the United States is engaged. As Director of OCDM I will have authority to control facilities or stations for wire and radio communication *only* upon proclamation by the President that there exists a state of war involving the United States. In any discussion of wartime emergency powers, this definite limitation must be remembered.

There is an additional delegation of authority that should be discussed. The President has indicated his wish that his emergency powers be exercised by an Administrator of an Emergency Communications Agency, established upon order of the President. Therefore, planning in the field of telecommunications has been concerned, in part, with the establishment of the organization structure through which the President's wartime powers will be exercised in an emergency.

There is no doubt that the Administrator of the Emergency Agency, if it becomes active, will have authority to completely and literally control national telecommunications. The existence of the force that necessitates the formation of the agency leaves us no choice.

This control, as we visualize it, however, will be of an affirmative nature. There are no plans for control merely for the sake of control. This is a procedure whereby the Administrator will be able to take actions in support of government agency, common carriers, and even private communication entities.

(*Continued on page* 61)

*spatial comprehension**...

cai

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(*Continued from page* 25)

of the earth, and ultimately this may be done; but the requirements in satellite power, antenna gain and accuracy of orientation are too great for early implementation.

Even at this great altitude, a considerable region in the Arctic falls outside the area served. There is a triangular region extending from a maximum of 17.5 degrees to a minimum of 8.5 degrees from the pole which can not be reached even at glancing incidence.

Now HF communication is particularly unreliable in the auroral regions where blackouts may extend for days at a time. Since communication with aircraft can only be achieved by radio, and since the polar regions are strategically important, satellites are particularly valuable in connection with the positive control of SAC aircraft.

So far we have been concerned mainly with various important types of communication satellites and the coverage that they can afford. I would like to take up next the characteristics of such satellites.

First of all, it should be pointed out that the principal limitation on communication capacity is imposed by the satellite to earth link, not the earth to satellite link. This is because when the same frequency and the same antennas are used in both cases, the ratio of the power received by the satellite station to the power received by the earth station is in inverse ratio to the transmitter power at the two stations. Since the power of the ground transmitter is normally thousands of times greater than the power of the satellite transmitter, this becomes the governing factor, rather than the relatively minor differences in receiver sensitivity.

The 24-hour instantaneous satellite would, as I mentioned before, have to operate at an altitude of about 22,000 miles out there. At this altitude the oriented satellite has an advantage in bandwidth of about 100 to 1 over an unoriented or spinning satellite using the same radiated power and the same ground equipment, and this gain is well worth striving for. In this case the curves show that by using a ground antenna having a diameter of 60′ or an area of about 3,000 square feet, we would get about 30 kc/watt using a non-oriented satellite, or with an oriented satellite about 3 megacycles bandwidth per watt of radiated power. Actually, although 3 mc is a very respectable communication bandwidth using an oriented satellite, it is desirable to start with a substantially higher bandwidth in order to provide adequate jam protection. Virtually all methods of jam resistance achieve protection by paying a price. This price may be in area coverage as in the case of the use of highly directional antennas (and this we have ruled out in the assumptions employed in this analysis) or by a severe reduction in the number of channels which are employed. In order to maintain a high communication capacity under jamming conditions an enormous initial bandwidth is mandatory.

Let us turn now to ground-to-air communication. It is assumed that the present state of the art does not permit use of tracking antennas on the aircraft. As a result the gain of the antenna must be assumed to be not much more than one. If we are to achieve continuous coverage with a reasonable number of satellites we will need to employ altitudes of several thousand miles. Operating in this region, one can see it is evident that there is a factor 10 to be gained by using a directional antenna on the satellite, but even if we do this and employ the most favorable frequency in the aircraft VHF channel, we will only get about 1 kc for each watt of radiated power. Actually, if we make proper allowance for auroral aircraft interference and the lower sensitivity of aircraft receivers compared to earth based receivers, a better figure is 100 cps. From this it follows that we could achieve teletype communications with about two watts and voice communication with around 50 watts. If we attempted voice communication with an unoriented satellite, it would require something like 500 watts of radiated power. Such a power level would produce very serious problems in terms of power supplies, heat dissipation, and effective operating life.

Now what are the factors that limit the rate at which we can develop the systems that we have been discussing? One very important factor is, of course, the matter of putting the payloads that we have been discussing into the orbits required. Each of the payloads is a matter of some hundreds of pounds. Presently existing boosters could handle the delayed repeater job. Mr. Johnson has indicated in unclassified Congressional testimony that the 24-hour orbit launching will be possible in about three years. Let us consider how such a maneuver is managed. The polar satellite is a task of intermediate difficulty, and should therefore be possible at an intermediate point in time.

Another factor is the development of attitude orientation systems. It is necessary to develop means for sensing the orientation of the satellite with respect to the earth, and for correcting this. The attitude must be controlled to an accuracy equivalent to a small fraction of the angle of the antenna beam, that is a few degrees, for the life of the satellite. A third factor pacing these developments is the matter of space power. I shall not say any more about this subject since it will be treated in a later talk.

A fourth pacing factor is the communication equipment itself. This must not only operate in accordance with the specifications but must continue to do so in unattended operation over a period of sufficient time to make it a sound economic investment to place it in orbit. Now this calls for increase in reliability of several orders of magnitude over present practice. Much of today's military electronic equipment has a lifetime measured in hours. It is our aim to achieve a lifetime of a year or more in order to make the expense of putting the payload in orbit pay off.

Now you may feel that the attempt to achieve success in all the lines indicated within the next few years is quite an undertaking, and, as a matter of fact, it is. However, before closing I'd like to peer a little further into the future. The programs I have been discussing up to this point are associated with payloads measured in hundreds of pounds. Further on down the road we will be able to put thousands and still later tens of thousands of pounds in orbit. This should permit broadening the bandwidth to a number of television channels. It should permit the accurate satellite orientation, high powered, and accurately beamed high gain antennas necessary for effective inter-satellite communication. Antennas at high gain accurately pointed toward the desired station on the earth will give very high channel capacity, even under jamming conditions and permit transmission of high speed digital data, picture facsimile transmission or television.

Finally, I would like to remark that while many potential uses of space are quite controversial, communication satellites are not. It is generally agreed that they are the brightest hope we have for ending the unreliability and congestion characterizing today's long range radio communications.

(*Please turn*)

PANEL: *Scientific Applications of Photography*

SPEAKER: *E. B. Woodford, ARDC, Wright-Patterson Air Force Base*

YOU HAVE GIVEN ME a big order in asking me to discuss "Photographic Reconnaissance for the Future." I had to decide on a suitable definition of "future" and also on a definition of photographic reconnaissance. If I were to choose a one-year look ahead my job would be easy because I am enough of a pessimist that if you were to ask what new things will be available in a year I would answer, "nothing much;" and if I were to choose a 50-year look ahead I would have to class myself as a writer of science fiction—I would be able to speak too freely! After careful consideration I have chosen to base my guesses on what photographic reconnaissance may be 10 years from now.

I also had to choose a definition for photographic reconnaissance. At first thought that might seem to be self-evident. But no, the first thing I did was to take out the word "aerial" so that I can go out into space where there is no air. Next I ask you to permit me to take liberties with the word "photography," so that I may include in this discussion the generalized notion of photon-sensitive image-forming devices. Finally, as to this matter of definitions, I have decided for now to define reconnaissance as that operation of collecting data about man's activities on the earth, data which can be converted into intelligence of military value.

You see that I have restricted my subject to this: "What new resources will be available 10 years hence for obtaining military information about the earth by photographic-like methods?"

At this point a few words are in order about the nature of military reconnaissance. One can state three important kinds of information which can be obtained in part from aerial or space photography: (1) warning of what the enemy is doing or where he may strike or, specifically, in peacetime, warning of an attack, (2) the locations of important targets must be obtained (*after* they are recognized of course), and this information must be in a form and of suitable accuracy for use by our weapons to strike the targets and (3) we must obtain technical intelligence about the enemy so that we won't be surprised by his scientific and technological progress, in order that we may develop countermeasures to his new weapons.

The role of photographic reconnaissance is somewhat different for those three kinds of intelligence. The warning problem is a difficult and complex one and requires integrating the photographic information with data from other sources of intelligence. The very nature of the warning problem indicates also that surveillance at periodic intervals is required. The target location problem of course brings mapping to mind.

Accuracy is an important part of this problem but there are two other important aspects of it: (1) speed with which the location data can be obtained; (2) the task of putting the data in a form suitable for use by the appropriate weapon. Technical intelligence calls for all the detail one can obtain, and this may call for more than can be accomplished by photography no matter how big the camera. A camouflaged object or a decoy might be so good as to fool you unless you can actually touch it. One of my bosses once remarked that some of the dummy rubber aircraft were so realistic that the only way one of them could be distinguished from the real thing would be to get a picture of the troops blowing it up!

It is obvious to you of course that the nature and difficulty of our photographic job also depends upon the size of the targets. Unfortunately, targets are getting smaller and smaller —this is true of most military targets certainly, such as launching sites.

From what I have said thus far, I think you will agree that 10 years from now we will need photographic equipment which can be integrated with other forms of reconnaissance, equipment and techniques which will yield photographic records of high precision, and large cameras and films capable of high acuity—since we must be able to obtain photographs of military value from airplanes at high altitudes and at hypersonic speeds and from satellites at several hundred miles.

This discussion of the problem of reconnaissance serves to highlight the chief goals of our WADC research and development program for photographic reconnaissance, *because:*

- Warning—calls for elimination of redundancy, integration with other sensors, the "automatic interpreter," and knowledge of the nature of military targets.
- Target location—calls for rapid mapping methods, recognition of targets, recording of navigation data, reduction of the photographic data to the "common denominator"—the form required by the military operation.
- Technical intelligence calls for extremely high acuity, which means better lenses and films, better processing and printing, and much of this to be operable under new, strange, and severe environmental conditions.

Just what will one be able to see in a photograph of the earth made from say 300 miles! For years prior to *4 October 1957* (!) we in aerial photography studied the problems presented by airplanes flying at 40,000 feet as contrasted to flights at 10,000 ft. *After* the October 4 date we found we must take a really giant step—from 40,000 ft. to 300 miles or so; a ratio of 45 to 1, not 4 to 1. I suppose all of you have seen good aerial photographs made from 40,000 ft. with, say, a 24-inch lens. We can hardly expect to obtain the same kind of photographic detail from 300 miles!

A photograph made with a 6-inch lens obliquely from a balloon at 92,000 ft., begins to look a little more like a picture made from a satellite. But we need still better simulations. ARDC has made some simulations of this sort from still smaller scale balloon pictures. If all other things are equal, then if the 40.000 ft. picture has a limit of resolution described by, let's say a sidewalk. then the limit of what will be seen in the 300 mile picture might be described by a big airplane runway. Of course the problem of estimating what we will be able to see from 300 miles is not that simple. The contrast and shape of the target enter into the problem, as does the associated detail which may reveal much that

(*Continued on page 46*)

— GOVERNMENT —

A BILL TO REVIVE THE INDUSTRIAL SECURITY PROGRAM has been introduced by Francis E. Walter, Chairman of the House Committee on Un-American Activities. It would authorize the Secretary of Defense to set up a security program for defense contractors and their employees, and deny access to classified material by individuals deemed to be security risks. The bill, which will take the form of an amendment to the 1950 Subversive Activities Control Act, was prompted by a Supreme Court decision holding that there was no authorization for the industrial security regulations that had been set up by the Defense Department.

THE PRESIDENT'S NEW SCIENCE ADVISER, George Kistiakowsky, was sworn in recently. Russian-born Dr. Kistiakowsky held the Chair of Abbott and James Lawrence Professor, Chemistry, at Harvard University from 1938 to the present. Dr. Kistiakowsky's predecessor, James Killian, has returned to his post as President of Massachusetts Institute of Technology.

CREATION OF THE BUREAU OF NAVAL WEAPONS was approved by the House Armed Services Committee recently. The new bureau would replace the Bureaus of Aeronautics and Ordnance and bring the Navy weapons system development work under one head. The bill creating the new bureau is being debated on the House floor and will be subject to further action in the Senate. If Congress enacts the bill during the present session, the new bureau could be set up by Jan. 1, 1960.

DATA ON SCIENTIFIC AND TECHNICAL PERSONNEL will be compiled by the National Science Foundation under a Federal program at the request of the Bureau of the Budget. The program will obtain statistical information on scientific personnel: their training and utilization, compensation levels, supply and demand, and other related data. NSF will use the facilities of other Federal statistical agencies in carrying out the program.

NASA CONTRACT APPEALS BOARD with final authority in settling disputes arising from National Aeronautics and Space Administration contracts was appointed by NASA Administrator T. Keith Glennan. The Board is headed by Paul G. Dembling, NASA Assistant General Counsel; other members are Robert Nunn and Ray Harris.

CONTRACTS: ARMY: Raytheon Co., continued production of Hawk missile, $161,000,000; Sperry Rand Corp., Sperry Utah Engineering Lab., production and continued development of Sergeant missile, $17,833,870; Western Electric Co., Inc., Nike spare parts and components, $751,020. NAVY: Melpar, Inc., production of target detecting devices for Talos missile, $1,500,000; Westinghouse Electric Corp., production of electric propulsion motors to be used in "Mark 37" anti-submarine torpedo, $760,000. AIR FORCE: Litton Industries, Electron Tube Div., electron tubes, $623,201; Photo-Sonic, Inc., 18 35-mm high-speed motion picture cameras, $175,393; NASA: General Dynamics, Inc., Convair Astronautics Div., initial funding for 8 two-stage Vega boosters, plus an additional Vega for captive firing tests, $7,500,000; Navy Bureau of Ordnance, 16 third-stage Delta rocket motors, $180,000.

— INTERNATIONAL —

BRITISH TRADE FAIR IN MOSCOW will open in May 1961 and will be sponsored jointly by the Association of British Chamber of Commerce and the All Union Chamber of Commerce of the USSR and organized by Industrial & Trade Fairs Ltd. The new exhibition buildings in Sokolniki Park, where the U. S. exhibition presently is being held, will be the site for the British show.

THE FIRST JOINT EUROPEAN-AMERICAN COMMUNICATIONS DEVELOPMENT FIRM was established recently in Rome. Formed by Page Communications Engineers, Inc., and the Societa Edison of Milan, Edison-Page, S.p.A. will provide advanced communications networks of high reliability in areas of the world where networks had been financially prohibitive. The only European firm of its kind unaffiliated with a communications equipment manufacturer, the new company will purchase equipment on the world market, according to Page Communications.

AN AGREEMENT TO PRODUCE THE HAWK MISSILE within their own countries has been signed by France, Italy, Germany, Belgium and Holland. Under terms of the pact with the U. S., the NATO nations will use their own monies, manpower and other production facilities. Elements of the surface-to-air Hawk will be produced in each country and parts interchanged with other countries to produce a complete system.

A FLYING SAUCER employing a lift principle fundamentally different from that of other craft was unveiled recently on the Isle of Wight, according to British sources. Built by Saunders-Roe Ltd. with financial help from the National Research Development Corp., the "Hovercraft" operates at heights just sufficient to clear waves or land surface irregularities and may be used for transportation purposes. The craft is supported on a cushion of air sucked in by a fan and blasted down through vertical nozzles.

SIBERIAN SCIENCE TOWN, which will become a research center for the eastern part of the USSR, is being constructed fifteen miles from Nobosibirsk, the largest industrial and cultural center in Siberia. The move follows a decision (May 1957) by the Soviet government to establish a Siberian branch of the Russian Academy of Sciences. The town will cover an area of 3,500 acres and will consist of 14 research institutes, a university, hotels and apartments.

ESTABLISHMENT OF A BRITISH METALS CO., Consolidated Beryllium, Ltd., was announced by the co-owners, The Beryllium Corp., Reading, Pa. and Imperial Smelting Corp. Ltd., London. The new firm will be managed by Imperial Smelting and will produce nuclear-grade beryllium metal and beryllium-copper master alloy as raw materials for sale to manufacturers in England and in Europe. Located at Avonmouth, Eng., the firm will be completed late this year.

— INDUSTRY —

WESTERN ELECTRONIC MANUFACTURERS ASSOCIATION is the new name for the West Coast Electronic Manufacturers Association. John A. Chartz, WEMA President, said the name change reflects the current growth of the West's electronics industry.

A HIGH-ALTITUDE JET PHOTOGRAPHIC AIRPLANE, which will increase the speed and accuracy of aerial commercial and governmental photo-mappers, will be produced by Lockheed Aircraft Corp. The new aircraft is a version of the JetStar jet utility airplane with engines mounted to the rear, which flies to altitudes of 10 miles. According to company officials, the JetStar photo-mapper could photograph twice the number of square miles in two-thirds the time required by propeller-driven airplanes on a typical mission.

AMPEX CORP. AND ORR INDUSTRIES, INC. WILL MERGE through the exchange of one share of Ampex common stock for each 2.2 shares of Orr common stock. Upon ratification by shareholders of both companies, Ampex will set aside about 209,000 Ampex shares for the transaction. The merger follows closely upon the Ampex formation of a new national stereo tape distribution division, United Stereo Tapes.

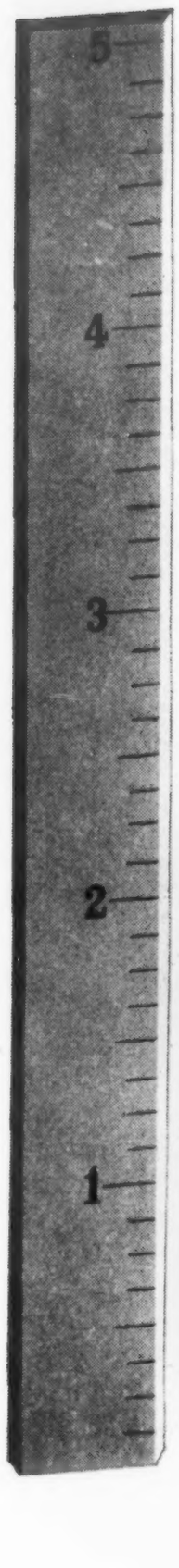
SPERRY GYROSCOPE CO. has been named navigation systems manager for the Navy's second-generation, 608-class Polaris submarines. This is the first navigation management contract awarded by the Navy to a private contractor, according to the Navy. It assigns full responsibility to Sperry's Marine Division for the most advanced underseas navigation equipment ever developed, the Navy said. The first increment of the contract is for about $2 million.

THE ADVANCED TECHNOLOGY CORP. has become a wholly owned subsidiary of Electronics Communications, Inc., St. Petersburg, Fla., through an exchange of stock. The group was formerly associated with Aerophysics Development Corp., now Curtiss-Wright Corp., and later with Avco Manufacturing Corp. It specializes in missile system studies and management projects and space and satellite research.

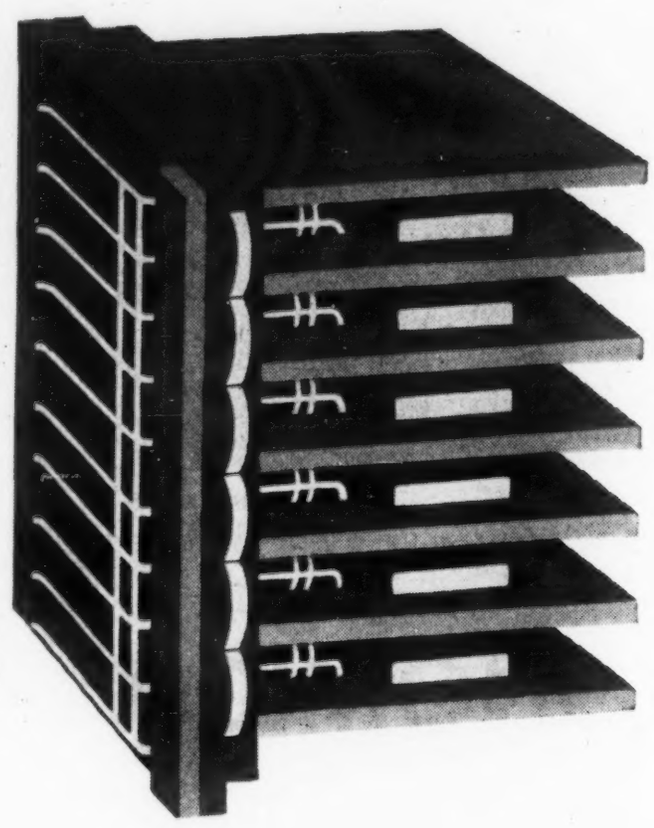
ON THE LIGHTER SIDE, a new light dimmer which enables a person to dial various degrees of light has been developed by the Moe Light Div. of Thomas Industries, Inc., Fort Atkinson, Wis. Moe Light engineers use a new principle in light dimming with a variable autotransformer which controls the amount of power used. Previous dimmers used all the power in the line, but dissipated the extra power in the dimmer itself.

GENERAL DYNAMICS CORP. AND MATERIAL SERVICE CORP. have agreed upon a merger through an exchange of stock. Terms of the transaction, which must be approved by shareholders of both corporations, were not disclosed. However, it is believed that well over 10% of General Dynamics' shares to be outstanding after the merger will be received for the Material Service stock.

(Continued on page 42)



New concepts in modular micro-miniaturization... by Bulova



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BULOVA

PART II

AN ENGINEER LOOKS AT

FIGURE 1

Diagrammatic view of waterway developments in European USSR, showing major dams completed. Work is less advanced on the associated irrigation systems, and those originating at Stalingrad have not been started.

ECONOMIC WARFARE

BY MAJ. GEN. E. C. ITSCHNER, USA, CHIEF OF ENGINEERS, U. S. ARMY

Synopsis: ***In Part I of his article, which appeared in the July issue, Gen. Itschner discussed the dangers and reasons for economic warfare. In this connection, he illustrates what Sino-Soviet countries are doing to develop their water resources—"one of the essential pillars upon which any expanding economy must rest solidly."***

THE SOVIETS ARE MAKING rapid strides in the technology of long-distance high-voltage transmission of electrical energy. One project, a 400 KV switching equipment which will operate at voltages higher than any utilized commercially in the United States, is now a reality. Our Bonneville Power Administration in the Pacific Northwest has a 345 KV line, which is normally operated at about 360 KV.

By 1965, the Soviet Union will probably have a single, unified power grid serving most of European Russia. The first big steps towards this are the recently completed 400-kilovolts lines from the Kuybyshev hydroelectric station on the Volga, westward to Moscow and eastward to the Urals.

The second big step will unite this system with the industrialized Donets Basin and lower Dnieper River regions.. This step is scheduled for completion about four years hence. One of the lines, they say, will operate on direct current at 800 KV.

By the mastery of even higher voltage DC transmission, the Soviets hope to be able to transport power economically from the giant Siberian plants into the highly industrialized European part of Russia, over distances of 1,500 to 2,500 miles. This would be comparable to transmitting power from Grand Coulee Dam to Chicago, Pittsburgh and New York.

Our most extensive system, operated by the American Electric Power Company at 345 KV, is 1250 circuit

miles long.

Also, several large thermal plants, such as the 1,000,000 KW plant in the Southern Ural mountains, are now under construction at sites adjacent to the vast fuel reserves in Western Siberia, where power can be produced at extremely low costs. These plants would be teamed with the hydro installations in providing enormous blocks of power for expanding Soviet industry.

In the development of their power resources, hydro and thermal, the Sino-Soviet Bloc is laying the foundation for tremendous economic strength. Should they fail in their drive to realize ambitious economic goals it most certainly will not be for lack of capability in the production and transmission of electrical energy. Now let us see what they are doing on inland waterway development.

Inland Waterway Development

Though the Soviet progress in inland waterway development is coming up fast, they are still far behind us in this aspect of water resources work, particularly in ability to use their navigation system. Figure 1 shows the famous Volga-Don navigation system, by which they are integrating the heart of European Russia with modern waterways connecting the Baltic and the Arctic, to the north, with the Caspian and Black Seas and thence to the Mediterranean to the south. This system, when completed, could even serve for the transit of small ocean going vessels, including destroyers and submarines.

The development of this system, now far along and already in use, is being carried out in conjunction with hydroelectric power. The navigation channels are for the most part a succession of lakes, formed by the reservoirs, with modern locks at the dams. The system also takes advantage of the opportunities to link the natural lakes of Northern Russia together by canals.

The Soviets are now concentrating on improving the northern reaches of the system, between Moscow and the Baltic, and expect to have a modern waterway, with depths of ten feet or more, in service from Leningrad to the Caspian Sea via Moscow, by 1965. It would be joined subsequently by waterways nearly as deep extending to the Arctic Ocean and by only slightly shallower routes to the Black Sea and into the Ural industrial area. Improvements also are being made or planned on certain of the great Siberian rivers, though various of these are navigable for long reaches in their natural state.

Soviet plans call for great increases in the capacity of the river fleet and port facilities by 1965. New, modern towboats of 1,200 horsepower are now being built for use on the inland waterways. They also are building more powerful craft, up to 2,200 horsepower, along with large barges, tankers and self-propelled freighters for use on the inland waterways. These towboats are small by our standards—our largest towboat, recently completed, has 8500 horsepower.

Soviet economic planning seems to have fallen behind their engineering achievements in the use of their waterways. Th principal factors preventing increased use of water transport appear to be the scarcity of modern river craft and of high-performance cargo handling equipment. Great stress is now being placed on modernization of the fleet.

Plans call for nearly doubling the cargo handling capacity of the inland waterway ports during the next 5 to 7 years through the installation of modern mechanical equipment. Modernized river port facilities are now to be found at the port of Gorki on the Volga River.

The expansion and modernization of the river fleet and port equipment should allow the diversion of much bulk freight from the overburdened Soviet railroads. The use of inland waterway transport for a greater share of the nation's haulage has long been a goal of the Soviet transportation planners, and it now appears that the country will soon be in a much better position to realize this objective. The effects on expansion of industrial capability undoubtedly will be great.

The opportunities for inland waterways development are markedly less in the European satellites. There the principal navigation system is the Danube, long an artery of traffic. However, work is under way to enlarge the connections between the Danube and the Rhine and Main rivers in West Germany, which will create a waterway system of unprecedented economic importance, bisecting Europe from the Atlantic to the Black Sea.

China

The rivers of China have even greater potential for navigation improvement. At present only 7,000 miles of the country's waterways can accommodate large river craft, but nearly 100,000 miles are used by small native craft, chiefly for local traffic. In navigation as in power, China has not yet begun large scale development, but the potential is there.

Certain improvements, however, have been built, including the Jenhochi Lock (one of a series of large locks) built on the Huai Ho in central China, where parts of the 200-mile system will accommodate vessels drawing up to 13 feet (Figure 2).

For some time to come, waterway improvement in Red China will probably be confined largely to the improvement of navigation aids, small scale dredging and the removal of minor obstructions. The situation is similar in North Viet Nam, where the Red River and its tributaries form a waterway network intensively used by small local craft. The rivers of mountainous North Korea have gradients too steep for navigation.

In flood control, however, China has far outstripped the other members of the Sino-Soviet Bloc, chiefly by the application of mass human labor on an unprecedented scale, even to the use of soldiers for repairing of a dike, etc.

While the flood problem is relatively minor in other members of the Bloc, it is an acute one for China and her teeming millions, many of whom live and work on the flood plains of great rivers.

In their first five years of power, the Red Chinese claim to have built and repaired 26,000 miles of levees, dredged 3,750 miles of waterways and built large numbers of dams, sluices and reservoirs, but these, for the most part, are small projects.

Completed in 1953, the Sanho regulating structure on the Huai Ho in central China is one of their most impressive works. Part of the Huai Ho flood control projects, it is 2,287 feet long and its 63 electrical-operated sluice gates will pass 283,000 cu. ft. of water per second. The river is directed into a 105-mile long canal to the Yellow Sea. From this canal, much of the water is diverted southward to provide increased irrigation water.

Virtually the entire Sino-Soviet Bloc is placing considerable stress, though greater in the Soviet Union and China than elsewhere, on irrigation as a means of increasing and stabilizing agricultural production. Shown in Figure 3 are the control works for serving irrigation from Chumysh Dam in Soviet Central Asia. The Soviets claim to have nearly trebled the area under irrigation. The area under irrigation in the USSR appears to have increased by six million acres, or 24.8 percent, from

1951 to 1955; while our own irrigated acreage increased about 5.5 million, or 21.6 percent. Some of their irrigation developments far outstrip the biggest American projects, ranging in size from 3½ million acres to one in the South Ukraine which embraces 8½ million acres.

A major share of China's agriculture has been conducted with irrigation for centuries, and the country had some 50 million acres under irrigation when the Reds took over. The Communists are placing great stress on the modernization of the old systems as well as the construction of new ones.

Hungary and Bulgaria are most concerned with irrigation among the European satellites and the great project for harnessing the Danube would provide for irrigating large acreages in Rumania and Yugoslavia. Work on the system is not to be initiated until the completion of other phases of the project. In all, the extension of irrigation within the East European countries will likely be relatively slight over the next five to ten years.

Conclusions

And now, what are the conclusions to be drawn from the Sino-Soviet water resources program?

First, I think, is the fact that the Communistic countries have a tremendous industrial potential, the capability for capitalizing upon it, and are looking far ahead in the prosecution of gigantic schemes for developing the water resources base. This places the strength of action behind words with which they have delivered an economic challenge to the Free World.

The fact is that they are making significant progress in the rate of water resources development, generally speaking, and particularly with respect to power, a basic factor in industrial expansion.

However, the problem in the United States is not to increase our own water resources development just for the sake of outdoing the Soviets, but to make certain that our development is sufficient to support our own requirements for economic expansion.

In the long conflict with the Communist World, we shall need economic expansion which ultimately will require the fullest possible development and use of our water resources.

The long way the Communists have yet to go will give us time to put our own programs in order; but we have no time to waste. For the present, we are much better prepared than the Communists for seizing the initiative aggressively and maintaining it indefinitely with respect to economic warfare. However, we cannot expect to maintain this advantage permanently unless we deliberately plan for it, for the Soviet nations are now in the early stages of developing tremendous economic power which some day could outstrip our own capability if we fail in our own preparations.

Secondly, we must realistically accept the fact that our preparations must be pointed toward an extremely long period of economic conflict, in which the strength and durability of the economic, social and political systems of both our country and the Soviet Bloc will be put to the severest test ever experienced.

The period of trial which we are entering could endure for centuries. We have such a precedent in the past. For example, another powerful nation for its day, the Turkish Empire, once arose out of the East; seized half of Europe; erected an impenetrable Iron Curtain; presented a great military challenge to the rest of the world; and in general provided a situation similar in many ways to the one now confronting us. For over 200 years, from late in the 14th century until early in the 17th, Western Civilization, the forerunner of our own, had to live co-existent with an unprecedented threat of being overwhelmed.

The Sino-Soviet Bloc presents a much more formidable adversary by today's standards than the Turks presented to Western Europe during the Dark Ages. It has been said that the power of the Turk finally crumbled because of his inability to create new wealth, for he lived as a scavenger on the productive capability of the peoples he had conquered, and his system lacked the dynamic economic drive to endure indefinitely.

Our opponents today do possess this economic drive and the potential resources against which to apply it, which in many ways are greater than those of the Free World.

And they have something else equally important: serious dedication to purpose by the average individual. Do we have such dedication, too? Is it informed and strong enough to win? Or are our cares for tomorrow dominated largely by such things as the latest styles in automobiles, or who is going to win the National League Pennant? We need to be sure about this aspect of our defenses in an economic war, as well as the material side of the question. Here is another facet of the complex challenge of the Soviet which must be examined if Western Civilization is to endure.

Figure 2

Lock on canal built in connection with Huai River flood-relief and irrigation project. This is one of the few major waterway improvement works undertaken by the Chinese Communists.

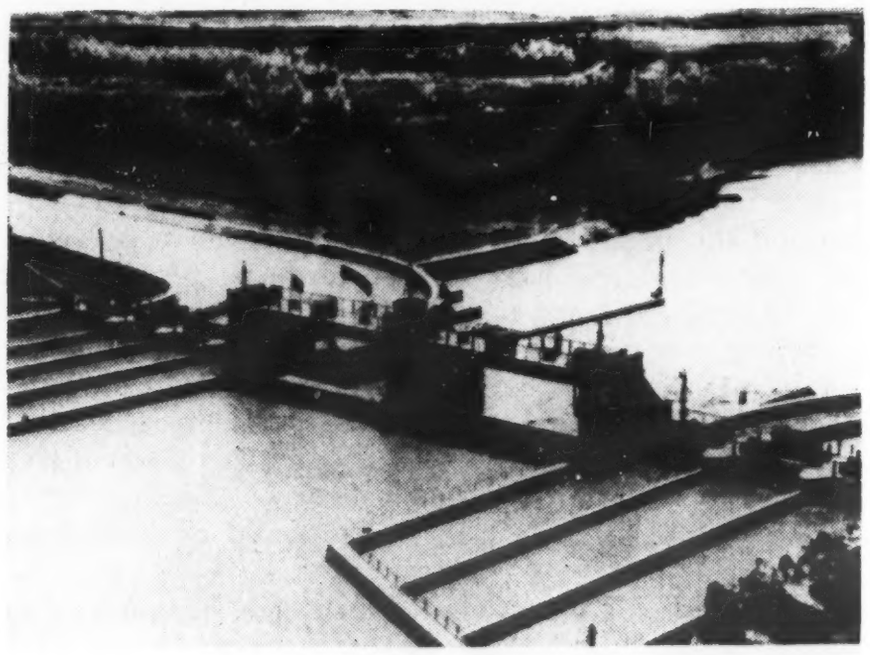


Figure 3

Head gates of Chumysh irrigation project in Soviet Central Asia, one of many major engineering works which the Soviets have completed in this area.

Aspects of R&D Today

(*Continued from page* 22)

in production contracts. When you consider such a vast increase of 300 million to, let us say, 10 billion a year in the brief period from World War II to date, you are viewing one of the most startling social developments in modern times. Also on this chart the dotted line is governmental research and this includes the huge government laboratories. That little line is industrial research and you will notice the stimulation to industrial research that has occurred from the Korean to the post-Korean period.

Chart II shows (p. 28) the spending for research and development along with where it is spent. On the left of the chart you will note that industry furnishes 64% of the money; the Federal government 33%, and the universities and research non-profit institutes 3%. Then on the right you see the university and research institutes actually spend 6% of the money. In other words they get 3% from the Army, Navy, Air Force, Dept. of Agriculture, all of the other governmental enterprises and from industry. This money is largely spent on fundamental research and in my opinion that small 6% slice of the pie is more fruitful for this country's future then all the rest of the pie. Now you will notice that the Federal government only spends 15% although it furnishes 33% of the money.

On chart III each of the three long black bars represents a year. Let us say that they are the last three years available; the last two being estimated; one being preliminary and one being estimated. Now, the part I want to highlight is the dark cross hatched part on the third bar of each one of those exhibits. That little cross hatch bar is so called fundamental research, and I would like to call your attention to the fact that percentage wise, that has grown faster by far then research and this is a measure of the sophistication of the U.S. after Sputnik I. If time permitted I would like to trace for you how America got its fundamental research largely from European sources and from the importation of European scientists into the U.S. We do not and did not have a climate that produced this kind of people because we called them eggheads and long-haired professors and absent-minded professors. In Europe they were great men. Now, the main thought in that chart is that in three years our percentage growth of fundamental research is high—much higher than our total growth of research.

The curves on chart IV portray the engineering graduates in the U.S. and Russia. Now in terms of number of graduates, we are graduating today about half as many engineers as Russia. If you are students of this field you are aware of the fact that the Russian engineer is an equally educated engineer to our own. The USSR secondary school system is ahead of our secondary school system. Now in the actual statistics of universities and higher education, there are not many more students in the universities of Russia then there are in the U.S. But, there are more students taking sciences and engineering and medicine voluntarily than we have, and this starts well down into their secondary schools where they are offered scholarships and incentives upon graduation if their marks are above a certain predetermined level.

On chart V you have the growth curve of your industry—the electronic industry. It is a fantastic curve and it has somewhat the same characteristics of the growth of the research characteristics except that it has occurred in more modern times. Now, I don't have to remind you that it was Dr. Hertz who in 1890 discovered electromagnetic waves and postulated their behavior and in 1895 Dr. Roentgen described the X-rays with higher energy electromagnetic waves. I think it was in 1898 that Sir J. J. Thomson in England discovered the electron. This was the beginning of the electronics industry but nobody knew it. Marconi, of course, shocked the world by his developments. Nikola Tesla—How many remember Nikola Tesla in his famous effort to transmit power without wires?

Well, these were the early days of the Edison effect, de Forest and Alexanderson. There was no real industry then, it really took World War II to get moving. Now, that first big hump on the chart and that little bracket you see above it is World War II. Notice how accurately the electronic stimulation for war needs reflected the emergency. Also note that immediately after the war it settled back to what would have been a fairly logical growth extension of the electronic industry curve, but it didn't stay there very long because (if you will look at the Korean War bracket) you will see that electronics started up again as soon as the Korean crisis was fully evaluated. Now that dotted curve you see down below (lower right) is the military side of your industry. You will note that the military side represents an investment of between three and four billion a year, as opposed to well over eight billion as the total of your industry. This is one of the really fantastic industrial growth histories of modern civilization.

Chart VI is interesting because it shows a budgetary reflection of what we are talking about. On the top of the chart are indicated Federal trends in expenditures for scientific research and development and you see represented a fairly typical growth curve. Below you see the percentage of the total Federal budget spent for research. That is the significant thing to watch. Look at the uniformity with which Federal funds as a percentage of total government budget are being applied to research. This growth, of course, is the direct measure of the technical challenges of the day viz-a-viz our competitors.

In summary, we find that science is a body of knowledge that can be measured, can be dealt with precisely and quantitatively and does not change with time or place, further that it progresses in an orderly way by speculation followed by experimental verification so that it definitely requires a suitable procurement philosophy, that engineering is the application of scientific knowledge to the useful purposes of man, and in our case today, to the national security. Thus, we find that engineers are motivated differently than scientists and vice versa, and they are not substitutes one for the other but constitute a team in their special field of research, development, and production. Thus, these two areas of procurement must take account of these differences.

In closing it can be said that your industry is the creation of scientific research and development whose beginning is as recent as Dr. Heinrich Hertz' experiments in 1890 with his discovery of electromagnetic waves and in 1898 Sir J. J. Thomson's discovery of the electron. Further the application of these discoveries and the later extension of knowledge has been to revolutionize communications for all mankind and thus to shorten time, and now as we approach the space age your industry will play an increasingly vital role in the conquest of interplanetary space with further new knowledge, whose portent cannot now even be foreseen. Such a role is not only honorable but vital to mankind's future and a thoughtful understanding of the factors that make this possible will not only spell out our progress for the future but will determine whether our nation can continue to be the world leader. Or perhaps we should say the interplanetary leader!

Signalgram (*Continued from page* 36)

RHEEM MANUFACTURING CO. has begun construction of a new 100,000 sq. ft. plant for its subsidiary, Rheem Semiconductor Corp. The new single-story structure will house the engineering, sales and administration departments of the corporation.

MANUFACTURERS OF ELECTRICAL INDICATING INSTRUMENTS have affiliated with the National Electrical Manufacturers Association as a new NEMA industry section. The section, which was authorized by the Association's Board of Governors at a recent meeting, is headed by W. H. Steinkamp, vice president, Daystrom, Inc.

GULTON INDUSTRIES, INC. has announced plans for the formation of a new unit, the Ortholog Division, whose purpose will be to extract usable information from telemetered or signal data during transmission. Located at Trenton, N. J., the division will also design and develop instruments that will be used in analyzing data to determine how much usable information it contains.

— GENERAL —

UNITED STATES' FIRST NUCLEAR-POWERED SURFACE WARSHIP, the "Long Beach," was launched recently at the Fore River Shipyard of Bethlehem Steel Company, Quincy, Mass. At present, the "Long Beach" and the Russian "Lenin," which was launched Dec. 2, 1957, but has not been to sea yet, are the world's only nuclear-powered surface ships. The first of three such ships being built by the Navy, the "Long Beach" is armed almost entirely with guided missiles and is designed for a speed in excess of 40 knots.

THE GEORGE I. BACK TROPHY FOR 1958 has been awarded to the communications personnel of the Middle East Area for outstanding operational efficiency in the world-wide Army Communications Administrative Network. Named in honor of Maj. Gen. George I. Back, (Ret.), former Chief Signal Officer of the Army during 1951-1955, the trophy is awarded annually to the major area maintaining the highest efficiency level of the Army's global communications network.

13,000 HAMS OPERATED 3,000 TRANSMITTER RECEIVER STATIONS during the 24-hour emergency exercise and contest recently sponsored by the American Radio Relay League, according to Perry Williams, Assistant Secretary of ARRL. Excellent radio conditions enabled new records to be set at the amateur Field Day, Mr. Williams noted.

A CREATIVE PHOTOGRAPHY EXHIBIT featuring the work of 35 noted photographers of several countries was held for the first time at the IBM Gallery of Arts and Sciences, New York City, recently. Alfred Eisenstaedt, Leslie Gill, Ernst Haas, Philippe Halsman, Gjon Mili, Y. Ernest Satow and Susan Greenburg were some of the participants in the exhibit which included photojournalism, portrait, illustration, experimental and general work.

MILITARY SALES OF ELECTRONIC COMPONENTS in 1958 amounted to 38.3% of a total components volume of more than $1½ billion, according to industry shipment figures compiled by the Electronics Production Resources Agency. Total components shipments in 1958, as reported by 500 plants representing 90% or more of the capacity for most of the categories covered, were $1,589,894,000, with the military share of that market $608,154,000.

A NEW TYPE OF ATOM SMASHER, which will be used to perform experiments on high-energy physics, will be developed at the Argonne National Laboratory, Lemont, Illinois. The new device will be the first high-energy accelerator in the Midwest. It is a "zero gradient synchorotron" designed to produce a greater number of accelerated particles than any multi-billion volt smasher in operation or under construction.

CALENDAR OF EVENTS:

AUGUST 26-SEPTEMBER 5: British Radio Show, Earls Court, London, Eng. Organized by the Radio Industry Council, this will be the 26th National Radio and Television Exhibition.

SEPTEMBER 1-2: Conference on physical chemistry in aerodynamics and space flight, jointly sponsored by the Air Force Office of Scientific Research and General Electric Co. Missile and Space Vehicle Dept., will be held at the University of Pennsylvania, Phila.

SEPTEMBER 10-11: Armed Forces Chemical Association, 14th Annual Meeting, Statler Hotel, Washington, D. C.

Ssociation, 14th A

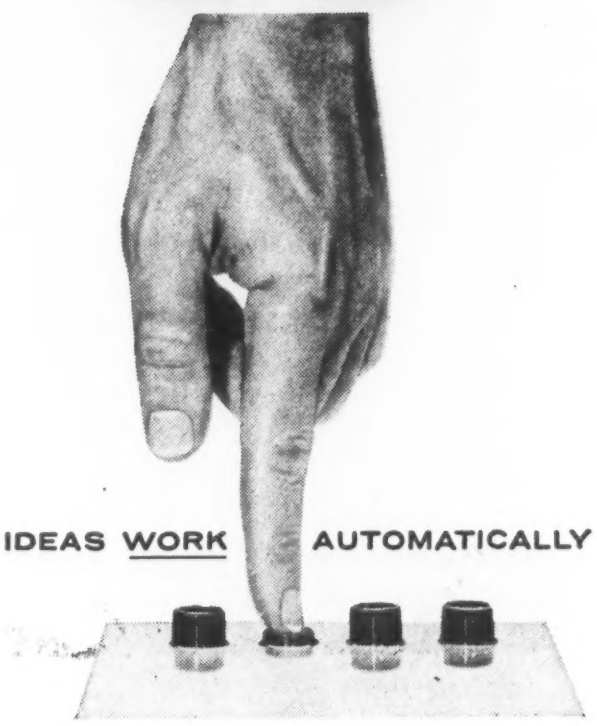
AE CAN DO

Set up a huddle of key figures at a missile base in a matter of seconds? It *has* been done—with sophisticated switching by AE.

The new Automatic Electric 3500-line exchange at Vandenberg Air Force Base makes it possible. Conference circuits can be set up automatically on any internal, incoming or outgoing calls, and a number of men can be placed on the line as the situation demands, with a complete recording being made of the conversation.

Engineers at AE are old hands at switching techniques such as this. That's why AE is well-equipped to solve problems in automatic control for the armed services – and see the job through.

If you have a project in communications or control, AE can assist in the design, and supply the components or complete control packages. For quick results, write the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Ill.



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Convention Chairman's Report

THE TUMULT and the shouting of June 3, 4, and 5 having died down and the exhibitors and the Conventioneers having departed, the rowen of our 1959 Convention is with us. We note with gratification that the Convention-goers-and-viewers say preponderantly complimentary things about our biggest yearly show.

As Chairman, I am thankful indeed for the help I received from all sides.

We of the Committee approached every Convention item with an eye to QUALITY, for which there is never any substitute. Note that Will Copp's exhibits were *quality;* that Dwight Agnew's Panel Discussions were *quality;* that John Gilbarte's Buffet and Reception were *quality*, and that the other events were similarly describable. This year the Ladies Events had a three-day Washington-and-environs tour motif, at specially arranged bargain prices; the tone of response was overwhelmingly favorable.

Official meetings of the Convention were held on June 2nd (Executive Committee), on June 3rd (Chapter Presidents), on June 4th (Council and Directors). The biggest news coming from the Executive Committee Meeting was that Colonel W. J. Baird, USA (Ret.), Editor of SIGNAL Magazine, was designated as the new "General Manager of AFCEA and Editor of SIGNAL Magazine"—an action stemming in part from my resignation in March as Executive Vice President. The Board of Directors on June 4th made this action official.

David R. Hull, of Raytheon, a longtime AFCEA member and director, Chairman of the Nominating Committee, presented a slate of names which the Board of Directors accepted without change. (The election results were listed in detail on page 41 of the July issue of SIGNAL.)

The Banquet and Buffet, with their Receptions, and the Keynote and Industrial Luncheons—our perennial social-professional events—were enthusiastically patronized. Here is a listing of preliminary figures of paid patronage, subject to final revision: Buffet, 1115; Buffet Reception, 509; Banquet, 1194; Banquet Reception, 414; Keynote Luncheon, 479; Industrial Luncheon, 241; Tour to Fort Meade Missile Master Site, 116; Ladies Events (total ticket sale for three days), 82; Total Registration, 4126.

The services of the Signal Corps in the fields of Public Relations and photography and in many other ways are acknowledged with heartfelt thanks. These services from the Chief Signal Officer's organization fill a long list.

K4NAA/3, the AFCEA "Ham" Station, set up prominently in the hotel lobby, was heavily populated during all its hours of operation. Rear Admiral Frank Virden, USN, Director, Naval Communications, and his officers and men handled this project. Two outstanding chief petty officers made themselves available during the three days. A huge success, K4NAA/3 gathered credit unto AFCEA and the Navy alike.

I should like to stress in this message that AFCEA's Convention was faithfully supported by all the Armed Services, and I wish I could in this message, pay every supporter the compliment he deserves. The same sentiments apply to *all* the loyal AFCEANS who contributed so liberally of their services.

With appreciation
W. B. GOULETT
1959 Convention Chairman

Exhibits

Ladies on Tour

Meeting Called to Order

Ladies' Chairman Convention Report

WHEN I WAS asked to be in charge of the Ladies' Activities for the 1959 AFCEA Convention, I accepted with mixed emotions. I thought it would be rather fun, but at the same time it sounded like a pretty big thing.

Since everything has to start with the first step, I put one of my 9 quadruple "A"s forward and went for pad and pencil. There is so much to see and do in Washington that I didn't know where to begin, also, since the convention is always held in the Nation's Capital, I had to be careful not to duplicate entertainment that had been done previously.

Being a rather selfish person at heart, I decided to take the ladies on tours that I would like to take. First, though, we must gather where I can talk up the tours and sell tickets. I was met with a little female opposition on the latter as the AFCEA ladies had always gotten things gratis before. But this is 1959, I thought, and we must pay as we go.

The Madison Room at the Sheraton-Park Hotel was assigned to me and on the first morning of the Convention we gathered there and got acquainted over coffee and cake. Mrs. Frederick Furth, Mrs. Thomas Jacocks, Mrs. Dwight Agnew, Mrs. Murrey Royar, Mrs. David Hull, Mrs. John Gilbarte and Mrs. William Christopher, acted as hostesses.

That afternoon, 31 of us were driven by Gray Line Bus to the Austrian, Philippine and Italian Embassies, where we enjoyed a conducted tour. It was intriguing to be on foreign soil without benefit of passport. We also stopped at the Islamic Center where we had a 30-minute lecture on Mohammedanism. We welcomed this pleasant respite as we took off our shoes and glided over the beautiful deep piled rugs. We finished the tours about five o'clock and had time for a rest before the gayety of the buffet supper.

The next morning, Thursday, 27 of us went on an all-day tour of Colonial Virginia. We went by bus to the Wilson Line dock where we boarded the boat for the hour trip down the Potomac to Mt. Vernon—the house, the tomb and the gardens. From there, we were taken by bus to Cedar Knoll Inn for a delectable luncheon. After luncheon, we drove over to Woodlawn Plantation and then on to Gunston Hall.

Friday was taken up with the church tour. We went first to the Franciscan Monastery, then to the Shrine of the Immaculate Conception. The tour ended at noon at the National Cathedral.

Although I was weary at the end of the three days of concentrated effort, it was offset by having met such charming ladies whose enthusiasm and genuine enjoyment made all the months of work worthwhile. I was actually sorry that my work had come to an end.

One husband, bless him, went on one of the tours and was extremely interested and complimentary. I would suggest that perhaps more husbands would like to go next year if nothing conflicted.

Mrs. Furth was a great help in acting as a hostess each day; with her warm and cordial personality, she made the out-of-town ladies feel very much at home.

I want to thank AFCEA for having made this all possible for me. I feel that as the result I have enriched my life in having seen so many fascinating places and added 31 new names to my list of friends and acquaintances.

ELIZABETH J. GOULETT
1959 Ladies Chairman

(*Continued from page* 34)

would not otherwise be interpretable.

(Editor's Note: Here the author showed an interesting pair of slides to illustrate his last point. The first slide was a large-scale, narrow-angle-view picture from a part of a picture of quite high resolution. There was one object on uniform background. One could not tell what it was even though the original negative had over 100 lines per mm resolution on it. Looking at a wide-angle view including that grey "blob," one could see at once that the "blob" was a pier. One knew this must be true because other detail associated with it enabled one to interpret the picture.)

Other reasons we are optimistic about the prospects of obtaining useful military information from satellites are because of recent improvements in our equipment and materials and the prospects for still more improvements. Films are more sensitive and will record finer detail than a few years ago. Lenses are better—we now are seriously considering use of lenses whose performance is limited only by the diffraction of the light. We know more about the effects of image motion and vibration and how to control these effects than ever before. These things and many more were progressing at a good pace for *airplane* photography—the space age has introduced the spur which has greatly accelerated that pace.

Some predictions of capabilities 10 years hence are probably in order at this point. Expressed in lines per mm resolved on the negative by a film having a sensitivity of (Exposure Index) 20, we should by then have lens-film combinations yielding 500 lines per mm as compared to the *practical* limit of 100 today. This would mean that a 6-inch camera at 300 miles would resolve about 24 feet on the ground and one would be able to see airplane runways, missile sites, etc. Again however, I must remind you that the intelligence you will get out of the pictures will depend on many other things in addition to what the simple arithmetic indicates. Some of those other things are: associated detail, contrast, camouflage, prior knowledge of the objects in the picture, etc. That same arithmetic indicates that our 500 lines per mm system will resolve about 6 inches at the 40,000 ft. altitude.

In either the airplane case or the satellite case such fine performance calls for minimizing the image blur caused by the distance the image moves during the exposure, *that is* good image motion compensation. Now the distance the image moves during exposure depends on the length of time the shutter is open and the speed at which the image is moving. This latter is a function of the angular rate of movement of the vehicle over the ground and the focal length of the camera lens. Thus, in the case of our 6-inch camera at 300 miles at 24,000 ft. sec. speed and assuming a shutter opening of 0.25 sec., if we are to retain essentially all of our 500 lines per mm resolution on our negative, then we can tolerate an error in our forward image motion compensation no greater than about 1.0%. 5.0% is the best we can do today. Ten years hence we will have reduced this to 1% or better. At first though you might think of that 25,000 ft. per sec. as being a big handicap. But, luck is with us for once in this case, because the important number is *angular* rate. In the satellite case the angular rate is not too great because the altitude is also great. It is interesting to note that the angular rate of travel over the earth's surface for a satellite at 25,000 feet per second at 300 miles altitude is about half that for an airplane at Mach 1 at 40,000 feet altitude—about 1°/sec.

In all of this I have been trying to show you the similarities and the differences in our problems of photographic reconnaissance as we go higher and faster. To recapitulate on this let us look at what you might call the spectrum of our problems as altitude and speed increase from subsonic speeds at "air-breathing" altitudes through supersonic and hypersonic speeds at altitudes up to a few hundred thousand feet, then on up to orbiting altitudes and the speeds required there.

The problems which are a function of altitude have already been discussed to some extent as have the problems presented by angular rates of speed. There is one other $2 expression, however, which includes some things we know but little about —*environmental effects*. By this term I mean to inciude all the effects of the environment—not only such things as the temperature of the air, if any, but also such things as: the optical effects in air at hypersonic speeds; the nature of the "Van Allen" radiation at various orbiting altitudes; the problems with equipment operation and materials at elevated temperatures caused by skin friction etc., the proper design of equipment for the Zero-G condition —and for long periods where reliable unattended operation is required; the design of equipment to withstand the high G forces of launching and recovery; and the effects of the turbulent atmosphere through which the camera looks.

We have already begun the study of the optical effects at high speeds. We already know a lot about the effects at supersonic speeds, say up to Mach 3.5. Up to that point we believe our problem is not too serious. The choice of the camera position with respect to the shock wave and to the layer of turbulence is important, otherwise distortions are introduced which will affect the precision of measurements from the photographs. One experiment on that question produced pictures with the camera shooting through the shock wave at Mach 1.3. The picture had a line across which, when measured in a stereoscopic plotting instrument, indicated a sudden change in elevation of 80 ft.—a pseudo cliff! The effects at hypersonic speeds—those above Mach 3.5 or so, are not well known. Ten years hence we will understand this and we will be able to compensate for such effects, I believe.

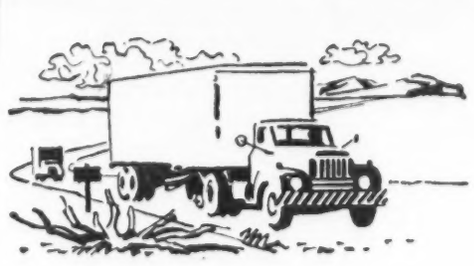
Since the Van Allen data from Pioneer III and Explorer IV satellites have become available, we have begun to speculate on the effect of these radiations on photograph films. The latest interpretation, I am pleased to report, indicates that with relatively light shielding we have no problem up to 500 miles. Ten years from now we *hope to have* photon-sensitive image-forming systems which will *not* be sensitive to nuclear radiation in the practical sense and therefore we should not be restricted to altitude because of radiation. One of our most important programs is that of developing an unconventional light-sensitive material or system which will have the additional advantages of being reusable, of requiring no processing, and of course having high resolution and sensitivity, high sensitivity to extend our photo capability into night.

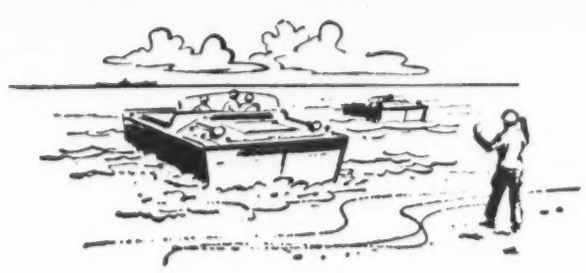
(Editor's Note: Here the author illustrated by slides what we hope some day to have by way of a reconnaissance system.)

Thus, to sum up, the research and development problems which we consider most important to photographic reconnaissance are: (1) high acuity cameras, films, printing and processing equipment and techniques; (2) systems of high sensitivity to extend the length of the "photographic day"; (3) new photon-sensitive im-

(*Continued on page* 48)

NOW..."PACKAGED" EARLY WARNING RADAR





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Easily transportable and quickly operational—that's the new "TEW" (Tactical Early Warning) radar system developed by Sperry's Surface Armament Division for the Marine Corps. Only one-fourth the size and weight of conventional radars, TEW—designated MPS-21—is easily carried to tactical areas by helicopter, cargo plane, truck or amphibious vehicle. Within two hours, an 18-man crew can erect the system and put it into operation.

Designed to detect both close-in and distant supersonic aircraft and missiles, TEW also determines their height—combining the functions of two present radar systems. Operation is almost completely automatic. Only one operator is required to monitor the control console. Radar console and rotating antenna are housed in an inflatable radome, which can withstand the rigors of arctic or tropical climates.

With its very long range and portable construction, TEW provides the means to extend the nation's defense perimeter and insure added protection for key installations and outposts. TEW is another important Sperry contribution to our growing power to deter aggression.

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Panel Discussions

(*Continued from page* 46)

age-forming systems which will be reusable, insensitive to nuclear radiation and require no processing; and (4) the special problems presented to us by the severe environmental and operational conditions which we are to face. We expect to be well along with solutions to those problems 10 years from now. For this we will need all the help we can get!

PANEL: ***Educational Programs in Electronics***

SPEAKER: ***L. M. Upchurch, Dean, Capitol Radio Engineering Institute***

I WOULD LIKE to begin by asking two questions: (1) What is a Technical Institute? (2) What is the need for the Technical Institute?

The Technical Institute is a post secondary institute whose curriculums are of two to three years duration and are technological in nature. The emphasis is on understanding and application of scientific principles rather than on the manual skills. The Technical Institute is distinct in character from the college or university because its purpose is to train men and women for the semi-professional technical occupations—generally defined as the area between the artisan and the highly scientific professional. The Technical Institute should not be confused with trade or vocational schools where emphasis is on the artisan. The courses offered at Technical Institutes are intensive, and the stress is on capacity and experience to a greater extent than on the credit unit.

The primary purpose of the Technical Institute is to graduate students who are prepared for immediate productivity and responsibility. States E. H. Rietzke, President, Capitol Radio Engineering Institute (CREI): "Since 1927, when we offered the first advanced course in practical radio engineering, CREI has been dedicated to increasing its store of electronics knowledge. To perceive the brain-power needs of industry and the Armed Services in our chosen field of technical electronics education; to meet those needs effectively; to keep pace with changing, expanding techniques and disciplines; to interpret theory in terms which can be mastered by technicians—these are our objectives."

It is difficult to determine when the first technical institute was founded. The first institute in America to give technical institute instruction was the United States Military Academy, probably in 1802.

Stephen Van Rensselaer founded the first formally organized civilian school of engineering in any English speaking country in 1824. The first course at Rensselaer Polytechnic Institute (R.P.I.) was a one year program, a part of this time the student spent on farms and in factories. The purpose of this course was to teach "sons and daughters of farmers and mechanics" the application of science "to agriculture, domestic economy, the arts and manufactures." The first technical institute was present in form in the academy founded in 1751 by Franklin. Around 1820 several mechanics institutes were formed in the larger cities for the promotion of the useful arts. (Industrial Revolution and the advance of the railroad westward sparked this revolution).

The courses offered by those schools were technical institute type. Their aim and purpose were again "to teach sons and daughters of farmers and mechanics" the application of science.

The surge of the technical institute movement leveled off at the turn of the century. The technical institute received its next impetus from World War I. However, it again leveled off in the 20's. There was a noticeable tendency on the part of industry to place emphasis upon the possession of a degree, and this tendency was accentuated by the depression in the early 30's and the scarcity of technical positions.

Many schools abandoned their technical curriculums to concentrate upon 4-year engineering courses. Among them were Carnegie Institute of Technology; Brooklyn Polytechnic Institute; Cooper Union; Pratt Institute. The rest, through loyalty to the purpose of their founders or tenacity of their directors, have evolved into the present day technical institute.

During the past 25 years, another resurgence, greater than all the previous ones combined, lifted the position of the technical institute to what it is today.

Probable reasons for this resurgence are:

1. The publication of the Spahr-Wickenden Report (1933). This report produced almost indisputable evidence that industry needs a ratio of 3 engineering technicians to one engineer. (Currently we graduate approximately 4 engineers to 1 engineering technician. To attain the indicated ratio we need to increase our technical institute grades 12 fold).
2. The Society for the Promotion of Engineering Education's study of the Technical Institute.
3. Accreditation of Technical Institute Curriculums by the E. C. P. D. (1945).
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The program of the technical institute is terminal. The entire curriculum is integrated and directed toward training in a particular field. This is in contrast to the curriculum of the four or five year engineering college which is often the same over the first two years for all students in all branches of engineering and more recently for the first four of a five year program. The engineering college emphasizes broad basic theory; the technical institute places more emphasis on special applications of theory with a large amount of laboratory experimentation to illustrate application of that theory.

In the engineering college the application is subordinate to theory. In a technical institute theory is taught with emphasis to practical application. Post high school mathematics is taught with specific application to the specialty concerned. A basic educational tool of the technical institute is the laboratory. The technical institute student spends at least

(*Continued on page* 50)

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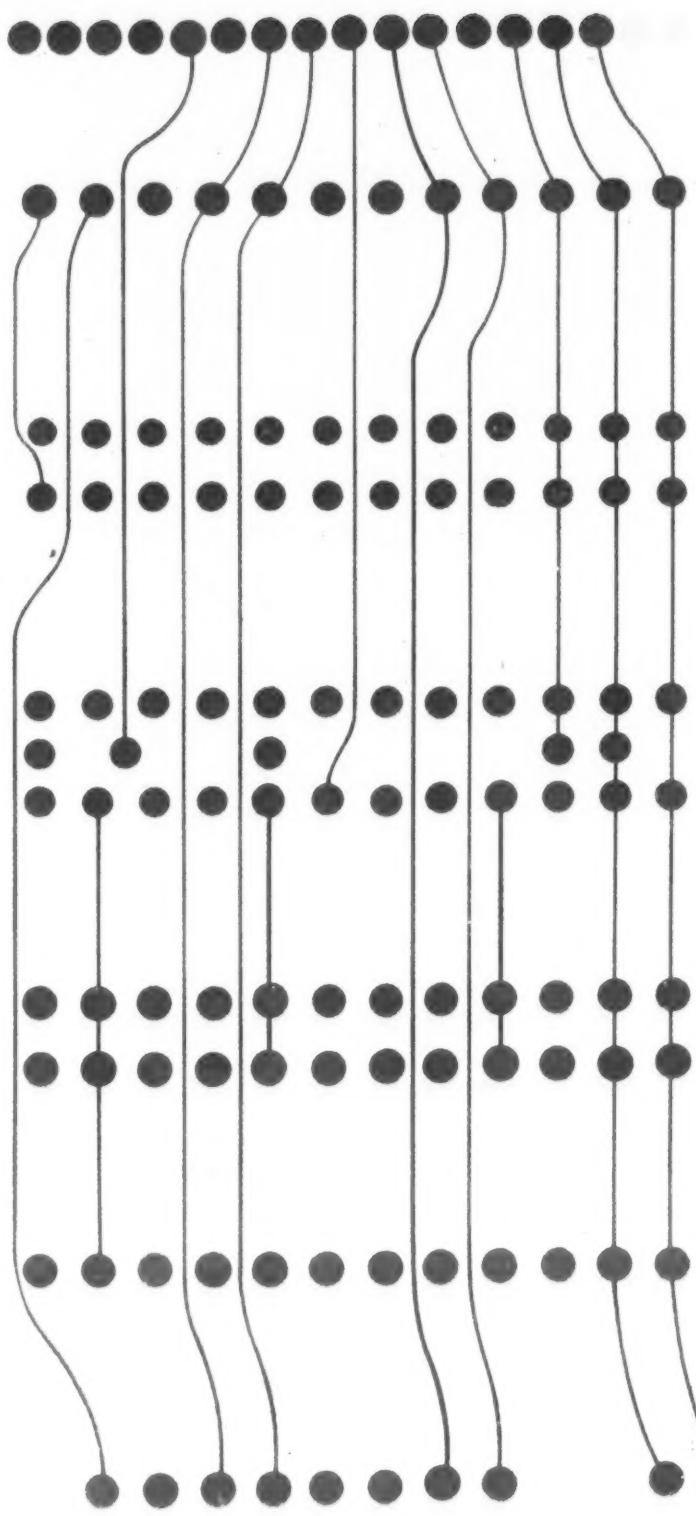

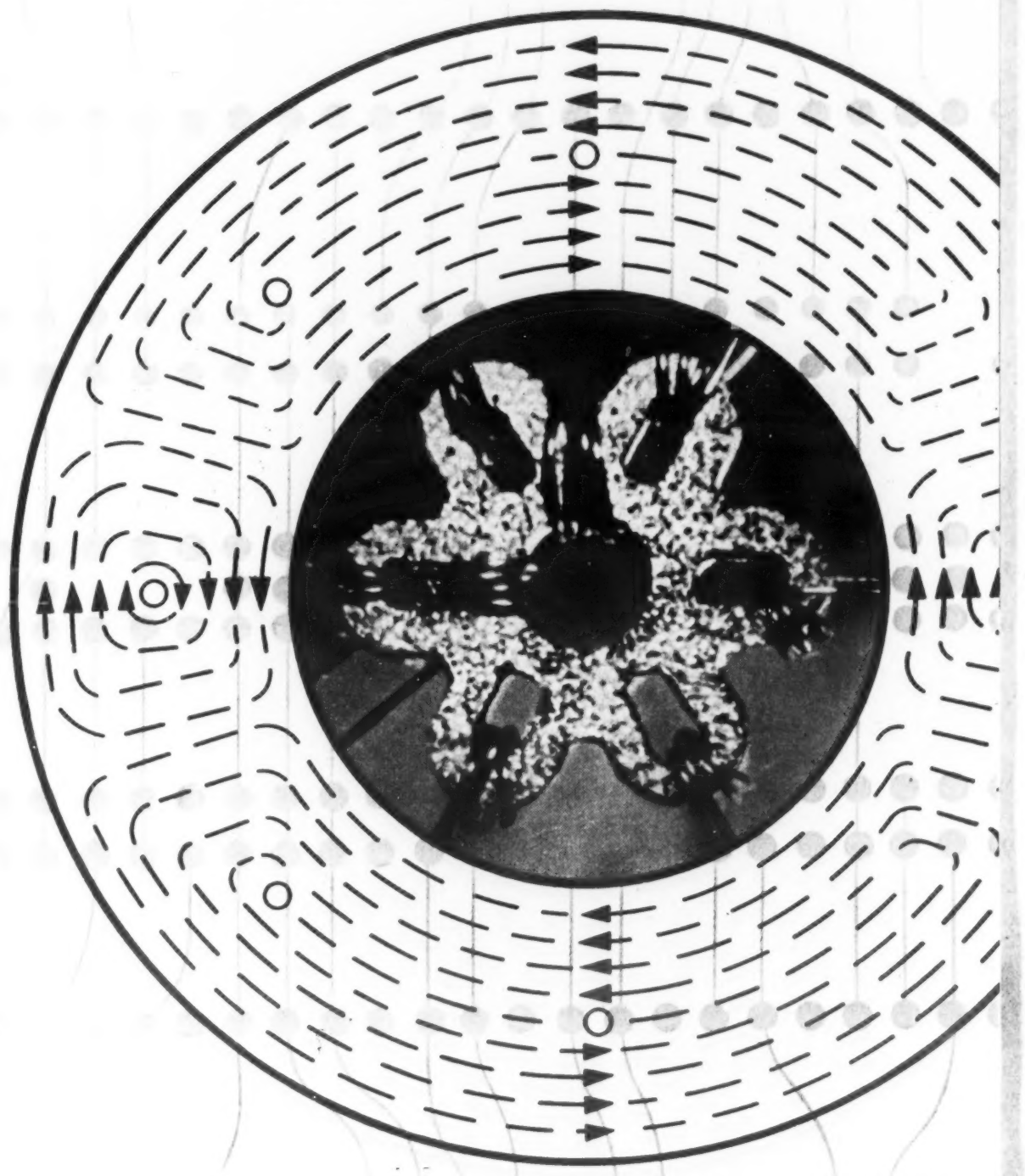

Panel Discussions

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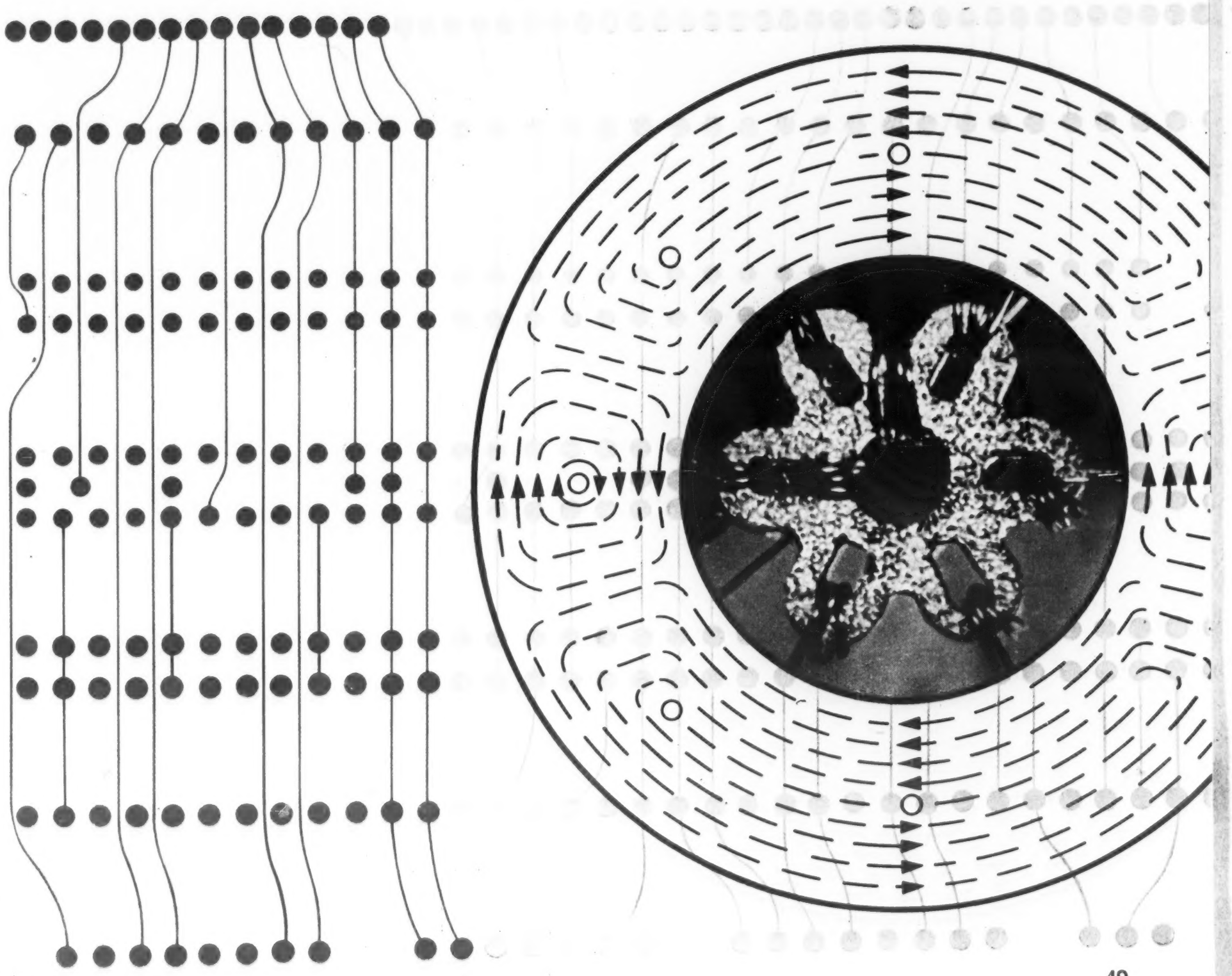


1/3 of his time in the laboratory. This allows him to test and corroberate the theory he has just learned in the lecture classroom. The average technical institute graduate spends more time in the lab than the average graduate of a 4-year engineering school. The technical institute method is in direct contrast to what has been called the "cold storage education" method of the engineering college. Cold storage education is the teaching of a large body of principles and technical facts before the student has any use for these facts, hoping that when a use appears, the student will immediately recall these principles and facts, and make appropriate application of them. (The Co-op system introduced by the University of Cincinnati in 1906 is one answer to the cold storage system).

The Land Grant College Act of 1862 placed great emphasis on the practical phases of education and research. It was largely an applied program, not a theoretical one. The aim was to give the agriculturist practical knowledge which would help him to bring forth a greater yield from the soil and to give him assistance in the management of his land and stock.

The early agricultural school was actually a technical institute. The emphasis has shifted; while practical phases are not completely obliterated, at present more attention is being paid to the theoretical concepts.

Of engineering I believe the same thing can be said. Thirty some years ago the emphasis was on what might be considered practical aspects of engineering. In general, the student was trained as a technician for a particular type of specialty work. As in the agricultural college the emphasis shifted. Shop courses were omitted and manual dexterity was de-emphasized. Mathematics and the physical sciences were increasingly stressed in the educational program.

Today many educators fear that we are overemphasizing the theoretical aspects of engineering science to a point where we are losing the practical approach.

I quote W. Leighton Collins, Professor, University of Illinois, Secretary of A.S.E.E., from the *New York Herald Tribune:* "There no longer is time in the customary four or five year curriculum for much practical work."

I believe this is where the technical institute graduate fills a large gap. Practicality is of great importance, and the technical institute graduate is a practical engineer. Many large companies recruit CREI grads for jobs that 15 years ago required 4 year engineering school grads.

While I do not presume to offer the Soviet educational system as a criterion, I feel sure that you are aware of the fact the Soviet Union has made considerable strides in the technological field. I feel that a primary factor for their success is that they graduate a greater number of students from the *Technikum* t we do from our technical institu Russia produces about 30 techn institute graduates to one in United States. Last year in a spe at an AFCEA luncheon the Un Secretary of Labor stated that great need in the United States w not for engineers and scientists b for supporting personnel such graduates from a two year technic institute.

Our educational methods over period of many years unquestionab have produced the kind of men wh can and do produce scientific an technical achievements of unsu passed magnitude.

Also our skill and ingenuity shoul not be sold short. But there is on aspect of this problem which cause me great concern. It is the compara tive rate of progress in Russia and in the United States. However, it is only in recent years that Russia has been able to make outstanding mass creative efforts in science and technology. Therefore, it would be very unwise for us to be satisfied with our own attainments in education. We must explore every possibility to improve our rate of progress and thus insure our continued superiority.

In conclusion, I believe that the technical institute graduate is an integral part of the massive scientific development of our country, and he is essential if we are to realize the vast potential of our economic promise.

PANEL: *Military and Industrial Aspects of R&D Management*

INTRODUCTION: *James M. Bridges, Moderator*

MANAGEMENT of the Department of Defense research and engineering effort, which is now close to $5 billion a year, is a big and tremendously complex job. Because the objectives and motivations in military research and engineering are quite different from those generally associated with non-military efforts, the management problems confronting those directing the military programs often have little parallel in the management of industry or university sponsored research and development programs.

Perhaps the most important difference is that of motivation. Military research and engineering effort is motivated by the urgency of national defense in an era of cold war. Non-military research and development is motivated principally by the incentive of profit or man's fundamental desire to expand his knowledge into unexplored frontiers of science. These differences in motivation and objectives account for rather striking differences in the values by which the effectiveness of management is measured. The relationships and the balance among such management considerations as cost, time scale and degree of technological advancement may be quite different in a military research and development program than in an industry or university sponsored venture. The management decision to proceed or not to proceed with a particular commercial R&D project can usually be made on the basis of some pretty tangible factors concerning cost of the development, the market for the product resulting from the development and the competitive situation existing in the particular product area. Unfortunately, it is not possible to make a management decision to proceed or not to proceed with a new weapon system development on such a clear-cut basis. This decision must be based primarily on such factors as the critical need for the new weapon to maintain our military strength in relation to that of the communist nations, upon the state of technology involved, and upon the relative urgency of the particular weapon development program with respect to other programs competing for support within a limited RDT&E budget. This brings management to consideration of the broad and rather intangible problem of the relative level of emphasis to be placed on R&D programs in support of retaliatory capability as compared to continental defense or general vs. limited war objectives.

Another factor which influences Defense research and development management decisions to a greater degree than in most non-Defense pro-

grams is the complex technical and tactical inter-relationships of different weapons and weapon systems. In the area of electronics this inter-relationship is well illustrated by the continental air defense system which consists of heavy early warning radars, surveillance radars, gap fillers, airborne early warning systems, communication systems, data links, data processing computers, guided missile and interceptor control systems, and many other electronic equipments and devices. Research and development on any one of these system components cannot be sensibly undertaken without giving careful consideration to its relationship to other parts of the over-all system complex. For example, little would be gained in starting an R&D program to extend the range performance of a surface-to-air missile system without initiating a concurrent program to extend the range of the radars needed to detect and track targets.

The fact that there are these unique and often extremely complex management factors associated with the planning and direction of military research and engineering is not generally understood by management people unfamiliar with Defense problems. As a result it is sometimes not recognized that the effective management of Defense research and engineering programs requires specialized skills and experience not readily available on the open market.

Since the end of World War II there have been revolutionary changes in the concepts of warfare and these have been accompanied by a radical advance in the importance of technology. These changes have occurred very rapidly and have been accompanied not only by a tremendous growth in our R&D effort but by a continual increase in the complexity of weapons and weapons systems—and these changes have obviously altered the scope and complexion of the management problems.

In order to streamline and strengthen research and engineering management, many changes have taken place during recent years in organization and concepts in the Military Departments and in the Office of the Secretary of Defense. Even so, it has been extremely difficult to keep our management capabilities in tune with the rapidly changing research and development picture, particularly since the pressures of world tensions have demanded greater and greater technological accomplishments in shorter and shorter research and development time cycles.

The research and development management changes which have taken place within the Defense structure have had a substantial effect upon the relationships between the military agencies and industry. Perhaps the most significant change as far as government-industry relationships are concerned has been associated with the management of large weapon system developments. These systems have become so complicated and the inter-relationships of the various elements so critical that it is no longer practical to develop the individual system components under separate management, either in the military establishment or in industry. This has resulted in the evolution of the prime systems contract management concept—and more recently the associated contractor structure—where a single management has the responsibility for administration and systems engineering of the entire weapon system.

While I doubt if the need for such over-all management responsibility for these complex systems can be seriously questioned, we must nevertheless realize that the weapons system concept has introduced new and difficult management problems. One of these is the adverse effect it has had on the over-all advancement of military technology.

I am most seriously concerned about the fact that during recent years we have placed so much of our national effort and research and engineering dollars on the development of weapons and weapons systems that we have not adequately supported the basic advancements in materials, components and techniques needed for the future. This is particularly true in the area of electronics and is clearly evident when we review the history of some of our major system developments and see the serious delays, performance compromises and cost over-runs which have resulted from failure of electronic component and technique development to meet the systems technical requirements and schedules.

To remedy this situation, more emphasis and support is now being given to research and exploratory development on components and techniques through expanded programs funded and managed separately from weapon system developments. When we have more adequately replenished our storehouse of new components and techniques, we will be able to develop weapon systems around proven concepts rather than take the gamble and pay the price in both time and money of doing expensive systems and hardware engineering based on unproven technology and components. Also, because there will be fewer technical unknowns associated with system developments it should be possible to do more of our development and engineering work on a fixed price basis. This should substantially reduce the cost of weapon system development thus making more money available for research and exploratory development of the new technology upon which the future strength of the nation depends.

Since industry performs a major portion of our total research and engineering work, the partnership between military and industry management is vitally important. Without a mutual understanding of each other's problems and viewpoints, this tremendous research and engineering enterprise, which is so vital to the future of all of us, can bog down in a swamp of administrative red-tape and misunderstandings.

This forenoon we have assembled a panel of eminent and qualified people from the military departments and from industry to discuss some of these management problems. Each of our panel members has broad experience in the management of Defense research and engineering, either in the military or industry or both. Each of the panelists will speak for about ten or fifteen minutes. At the conclusion of the presentation, the session will be open for general discussion and questions from the floor are invited.

SPEAKER: ***J. D. McLean, President, Hoffman Laboratories***

MY TALK TODAY will cover the GROUP and TEAM Contracting approach to the research and development of weapons system programs. First let's define TEAM contracting as we at Hoffman are using it—and then describe some of its significant elements.

Many definitions and descriptions of TEAM contracting exist— and they are as widely divergent as these:

Some people say that the concept is no different than the usual Prime-Subcontractor relationship—with the subcontractors identified as "members

of the team."

Others see a TEAM as some form of organization or synthetic organization of companies banded "together" for the acquisition and accomplishment of a particular program.

And others contemplate it as a totally new organization—profit or non-profit—to provide central management of a program—similar to the "Six Companies" that built Boulder Dam many years ago.

Our definition (and the way we feel a TEAM should be organized and operated) contains something of each of these definitions but is, in essence, quite different than any of them.

Of course if you want a *literal* definition—TEAM contracting is simply the combination of two or more organizations into a task force for the accomplishment of a specific program.

In our thinking there are several important elements that must be considered—if a TEAM effort is to be successful—

First—the TEAM must be assembled well in advance of the Request For Proposal (RFP) and the members must be chosen by the TEAM leader to provide outstanding specialty skills for the program—

Secondly—the task or program must be broken down into its prime elements—and these sub-tasks must be assigned to the various TEAM members for the preparation of the management and technical proposals, the oral presentation and the price proposal.

In short—the TEAM is selected—or, if you will, designed—expressly for the execution of a *particular* program—and consists only of those organizations who are experts in the particular fields. Of course, it is assumed some advanced knowledge of the customer's requirements is available long before the usual 30-day bid preparation period—and that creative study and analysis of *all* the TEAM members has been under way for some time.

Thirdly—it is important that one organization is "*The Boss.*" The LEADER organization provides undivided single-point responsibility for performance of the entire program—and must retain the requisite authority to maintain timely and effective performance from *all* TEAM members.

And fourth—We strongly feel that within the framework of single-point authority—and the responsibility of the TEAM leader for program performance—that there be created and maintained a true *DEVELOPMENT PARTNERSHIP*—between all TEAM members, the leader, and the customer. We know through much experience that effective TEAM contracting is accomplished to a great extent through the high motivation of all participants to provide their most creative and enthusiastic thinking and participation throughout an entire program—and we have found that this special motivation can be maintained by providing all TEAM members with continuing participation in PROGRAM POLICY DETERMINATIONS so that all can exert some influence on the general operating policies and direction of the entire program. Further, at all times, we make available to all TEAM members the complete plans, schedules, task descriptions and progress measurements concerning all work on the program, so that they can relate their efforts within the perspective of the complete program.

Now, we cannot perform adequately simply by calling one organization "The Boss" and exhorting the other organizations to continually do their best—the "Boss" really has to do some work—some very demanding and difficult work.

One of our project managers describes the role of the TEAM Leader succinctly as "always 300 yards out in front and running like the Devil!"

The proper role of the TEAM Leader is, of course, *LEADERSHIP*—dynamic, thoughtful and aggressive leadership in all technical, administrative and managerial areas.

In terms of the *mechanics* of this role, the TEAM Leader is the prime contractor to the customer; is the program manager and planner; prosecutes the systems engineering and conceptual design; prepares or approves the equipment specifications; may develop some of the equipment; exercises technical and administrative surveillance over all equipment developments; tests and integrates the system as an entity, and provides for its operational capability, including services and support in the field.

In terms of the *dynamics* of t role, the TEAM leader must dischar those responsibilities effectively wh still maintaining maximum motiv tion on the part of all TEAM membe to provide their best contributions the over-all system.

These are the broad and most e sential aspects of group contractin In a little more detail, here ar some of the operating techniqu and group attributes that we conside important:

1. The early formation of the TEA helps insure the later effectiv prosecution of the program. Th individuals and organizations in volved acquire considerable use ful experience in working together prior to and throughout the pro posal and negotiation phase. Roles and operating procedures become clarified during this period.
2. The individuals who contribute to the proposal are, in the main, those who perform the program. This maintains maximum knowledge, skill and motivation on the job—(The men who defined the job co-operatively are the best qualified to perform. and are instantly ready to start work).
3. The TEAM has tremendous reserves of skills and manpower available to the program to meet any unexpected changes in requirements or any emergency.
4. Planning and control are improved since the work is defined in detail at an early date.
5. Rapid response to change is assured, since a quick communications network is mandatory—such a network is necessarily established to assure timely performance from all TEAM members—
   Quick (TWX) communications are operative at all TEAM member locations—and at the customer's office.
   Central Document Control is established with after-publication recording.
   Assigned single points of contact exist at all locations.

This concludes my rather abbreviated description of Group Contracting—I hope that the discussion was sufficiently provocative to develop some interesting questions from you.

SPEAKER: ***Capt. Harold E. Ruble, USN, U. S. Navy Underwater Sound Lab., Fort Trumbull***

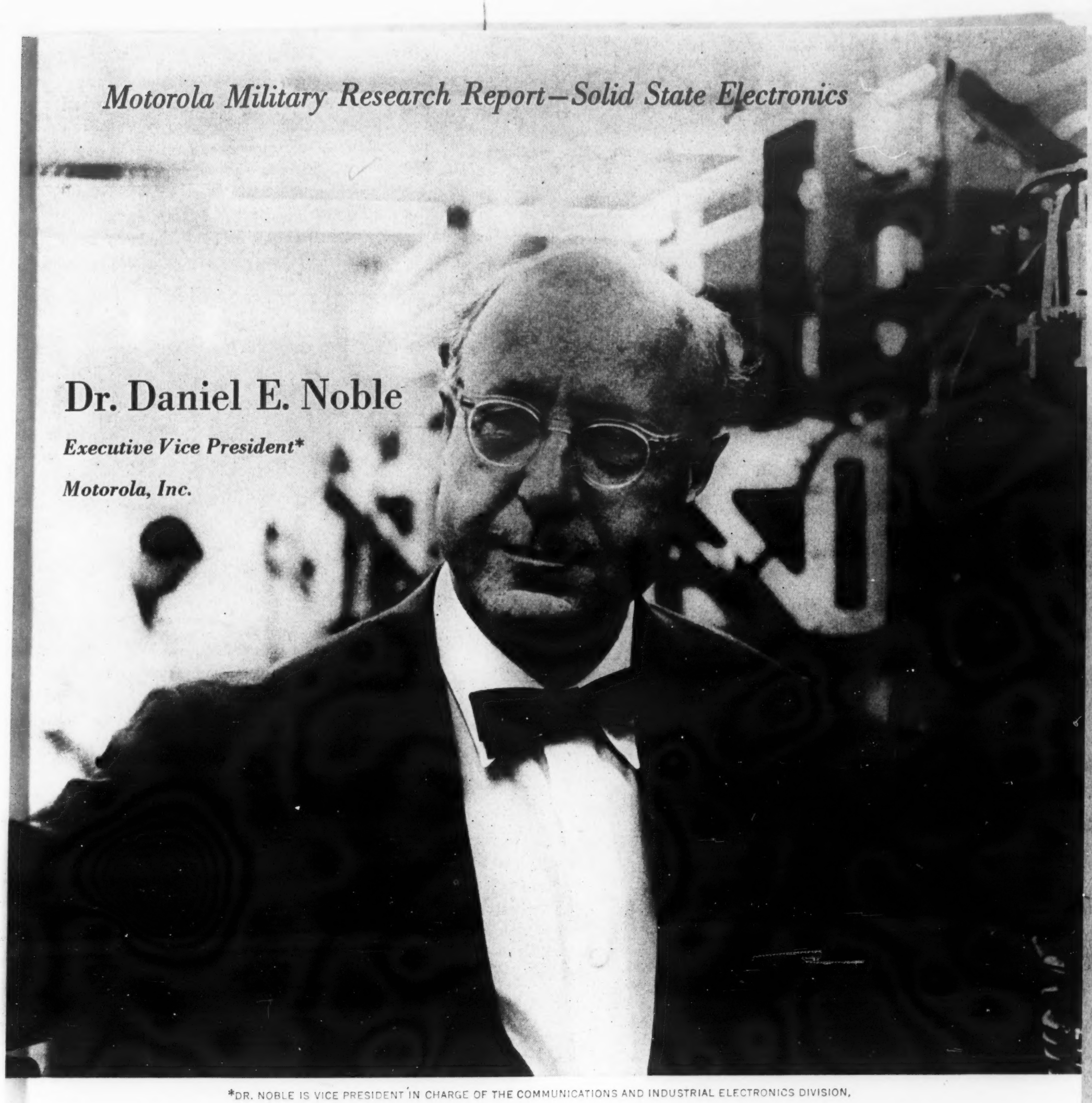
THE DICTIONARY defines management as "the judicious use of means to accomplish an end." I will briefly outline how we have used the means available to us in order to produce an integrated submarine sonar system.

The means available were the skills, knowledge and experience of Navy laboratories, Bureaus, Operating Forces, and Contractors. Our job was to combine all of these judiciously to meet our objective.

Two basic objectives were estab-

(*Continued on page* 56)

Motorola Military Research Report—Solid State Electronics



Dr. Daniel E. Noble

Executive Vice President*

Motorola, Inc.

*DR. NOBLE IS VICE PRESIDENT IN CHARGE OF THE COMMUNICATIONS AND INDUSTRIAL ELECTRONICS DIVISION, THE SEMICONDUCTOR PRODUCTS DIVISION AND THE MILITARY ELECTRONICS DIVISION OF MOTOROLA, INC.

"In this new era, Solid State Electronics will spread its influence to every form of human endeavor and will contribute substantially to scientific achievement in all fields."

Dan Noble

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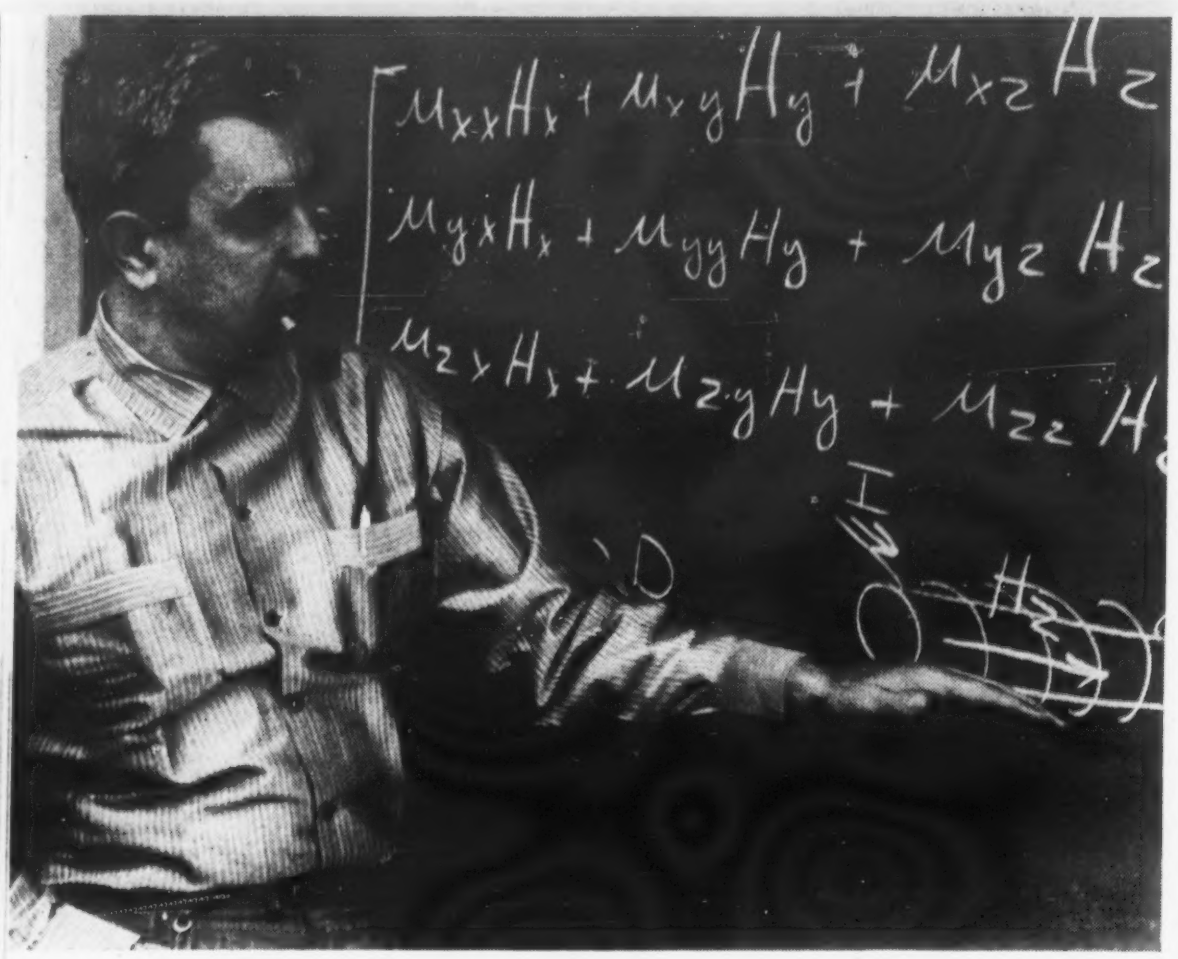
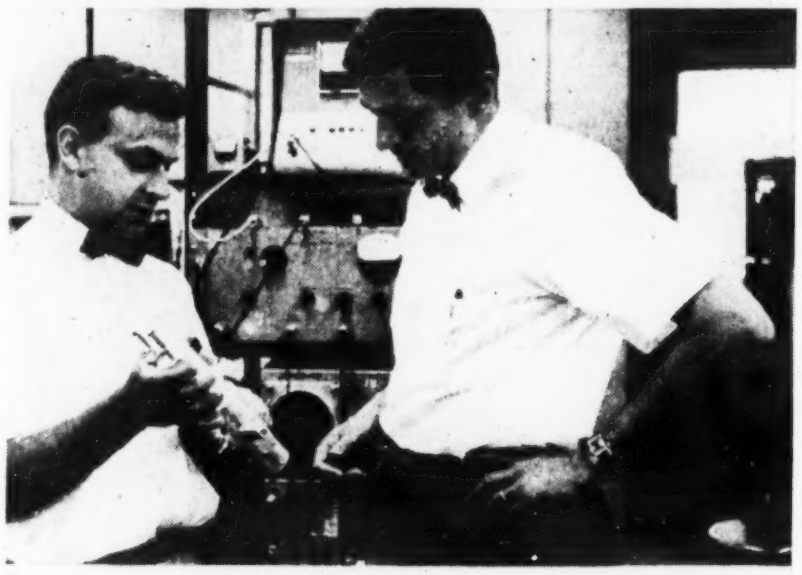


Ferrimagnetic principles are demonstrated by scientist in charge of Motorola's Solid State program, Dr. H. William Welch, Jr., director of research and development, Military Electronics Division. Dr. Welch as a University of Michigan professor established that school's Solid State laboratory and introduced new curricula in Solid State devices and their applications. He holds an I.R.E. Fellow Award for contributions to development of solid state devices and microwave tubes.

Typical of solid state materials now being offered for sale by Motorola are these ferrite rods and bars being examined by Donald L. Fresh, manager of the Solid State Materials Laboratory.

John C. Cacheris, right, manager of the Microwave Applications Laboratory, and a member of his staff inspect a parametric amplifier, one of several devices now being produced by Motorola's Solid State Dept.



Imaginative leadership plus the most modern of laboratory facilities have helped foster a creative environment that is attracting top talent to Motorola. Here, Dr. Arthur L. Aden, associate director of research and development for Motorola's Military Electronics Division, shows a new member of his staff equipment for photographing printed circuits. Dr. Aden welcomes inquiries from qualified engineers and physicists who would like to join his department.

James R. Black, manager of Motorola Microelectronics Laboratory, heads work which leads toward the mass production of economical microelectronic components so small that several would fit on the period that ends this sentence.

How Solid State Electronics is shaping the future

MILITARY ELECTRONICS—industry as well—is being radically changed by rapid advances in solid state technology. Predicted for the near future are computers small enough to fit in the palm of a hand, receivers that will detect the weakest signals from distant satellites.

Motorola's highly experienced Solid State Department, in close cooperation with the Semiconductor Products Division, is advancing the state of the art on several fronts, one of the most promising of which is microelectronics.

By making use of crystalline functional circuit elements created in volume quantities by surface etching or film deposition methods, Motorola researchers anticipate they will soon be able to design equipment with component densities of tens of millions per cubic foot.

This high density will result in a great reduction in systems and computer size coupled with a significant increase in reliability, and it will lead to the development of self organizing computers for such complex tasks as the solution of military logistics problems and space guidance.

In microelectronics and in other areas, Motorola scientists, including those of the Semiconductor Division, are investigating the ferroelectrical, ferrimagnetic, piezoelectrical and pyroelectrical characteristics of monocrystalline and polycrystalline solids. New materials possessing these useful characteristics are created and produced in the Materials Laboratory. Typical applications: newly developed ferroelectrical or piezoelectrical materials to be used in transducers for submarine detection.

At present, the Applications Laboratory is making extensive use of ferrites and semiconductors in the development of broad lines of isolators, circulators and parametric amplifiers. The latter device has already demonstrated its worth in satellite-tracking radars, IGY research receivers, uhf television receivers and radio. In the study and design stage are new and advanced ferrimagnetic devices such as microwave switches, ferrimagnetic limiters and semiconductor switches.

Still another research frontier where striking preliminary results have been achieved is a low-voltage facsimile paper for the transmission of teletype and other information. Applications in the fields of combat surveillance, logistics control and other important military programs are foreseen.

Military Electronics Division's expanding capability in solid state electronics is described in a new booklet entitled: "Solid State Frontiers at Motorola." *Request your copy from Technical Data Service, Motorola, Inc., Military Electronics Division, 8201 East McDowell Road, Scottsdale, Arizona.*

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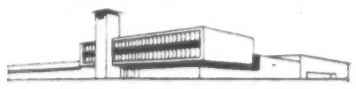

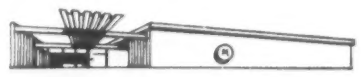

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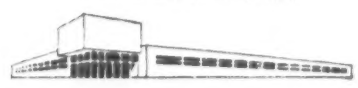

Panel Discussions

(*Continued from page 52*)

lished for the Integrated Submarine Sonar Project:

1. Combine existing techniques with results of research and development efforts to maximize sonar performance and meet all operational requirements for sonar on a specific submarine with improved operating characteristics.

2. Carry out a continuing program which produces at frequent intervals an advanced operational sonar system on an important class of submarine.

To accomplish the first, a definite time scale was required. A new construction submarine of the 585 (SKIPJACK) class scheduled for completion in November-December of 1960 was selected and the following time scale established:

Specifications—October 1957
Contract Award—February-March 1958
Delivery—February 1960
Ship Operational—November-December 1960

The following ground rules were laid down for specification preparation:

Technical personnel in one or more of the Navy's development activities must:

1. Know at least one method of designing each system component.
2. Be certain that an operationally reliable system component will result.
3. Be able to specify the characteristics of each system for procurement from a contractor.
4. Be sure that actual design, physical construction, and contractor's testing can be done in less than two years.

Discussions were held with the operating forces, representatives of government and commercial R&D activities. The general requirements for the system were established.

The following procedures were set up for selection of the system components:

1. Review ship's characteristics for submarine class selected.
2. Based on "ground rules," list components which could be used.
3. Predict performance and operating characteristics for components selected.
4. Based on 1 and 3, select a compatible combination of system components.

Liaison was established with the Weapons Development Groups in Bu-Ord in order that the system would meet to the maximum extent possible the requirements of the fire control system.

Predicted performance was calculated based on best available data and realistic assumptions. Using same prediction formula, performance of an existing sonar was calculated and these predictions compared with actual performance data obtained under operating conditions. This verified the soundness of calculated predicted performance.

The specification was prepared jointly by the Laboratory and Bureau of Ships engineers. Frequent discussions were held between sonar engineers and the hull design groups to insure compatibility of the system with the hull design, ship's power, and numerous other technical details requiring compatibility between the sonar equipment design and the hull design and machinery installations.

Prospective contractors were invited to send technical representatives to the Laboratory for a discussion of the specification. The specification was thoroughly reviewed, the objectives outlined, and various design approaches discussed. The specification was put out for contractors' proposals. Proposals were carefully reviewed by the Laboratory and Bureau engineers. The contract was awarded approximately on schedule.

The Laboratory and the Bureau each designated a Project Engineer to work closely with the prime and sub-contractors to solve problems as soon as they became obvious. The Laboratory, the Bureau, and the contractor have coordinated efforts to rapidly test experimental and final systems components. Direct liaison has been established with the building yard, and installation drawings are being provided as they become available.

At the present time the equipment fabrication is on schedule and components will be delivered to the installing shipyard when required. Final delivery is expected to be completed by February of 1960.

The Laboratory and contractor's engineers will work closely with the installing activity during installation and test.

After the ship is operational, the Laboratory and operating personnel, with assistance from the contractor, will carry out the technical evaluation of the equipment. This will be followed by an operational evaluation.

The Laboratory will continue to work closely with the operating personnel to improve the system by alteration or modification, if desirable. In addition, we will discuss with the operating personnel desirable changes and improvements for future systems. This brings us back where we started, working with the operators and other research and development activities to plan the design of an equipment for a 1965-1970 submarine.

We believe this project provides the following advantages:

1. R&D activities can expect their results to be rapidly incorporated in systems tailored to give maximum sonar system performance.
2. R&D effort can be extended and redirected based on earliest possible tactical employment of new techniques.
3. The most rapid possible advances are made in the tactical use of sonar equipment.

PANEL: ***Optimum Combination of Man and Machine for Maximum Reliability in Space Travel***

SPEAKER: ***Dr. Franklin Taylor, Naval Research Laboratory***

THE GREAT WEAKNESS of the human as an operator of a space craft is his variability. In top form, the man is often as good as or even better than a machine in accomplishing certain things. But when he is tired, or bored or stressed or ill he may do very poorly indeed. Thus, man, left entirely to his own devices, is an intrinsically unreliable system component. This causes many designers to suggest that man's role in space travel must be little more than that of a passenger.

But there is more to space flight than what is ordinarily meant by the term reliability. The vehicular systems which will invade space will also have to be adoptable. They will have to be self-healing in the sense that they can operate successfully when subsystems fail. Also they must be capable of changing their mode of operation in the face of unexpected external events. Because of this, it is almost certain that the human will have to be included as a functional part of the system, for the man is the cheapest and best adoptable system component which we have today.

So we know that the human must play an active system role in space flight, while we also know that he is unreliable. What can we do about this? Once we have decided to em-

ploy the man as a system component must we settle for a reliability which is fixed at some low level by the vagaries of human nature? I believe not. I will mention two ways of designing around the low reliability of the man which I think bear on the topic under discussion.

Minimization. The first item is minimization. The man is not equally unreliable in all of his skills. There is strong evidence that man-machine systems designed to require simple behaviors from the operator perform better and are more resistant to the degrading effects of human stress than are systems which make greater behavioral demands upon the human. This has been shown in a study done at the Naval Research Laboratory. We tested two different man-machine control systems while subjecting the operators to six kinds of "task-induced" stress. In one system the operators had a simple tracking task, they could act as simple rate controllers, in the other they had to employ a good deal of anticipation. The stress tasks included such things as reading a radar scope while controlling, controlling with the left hand after being trained with the right, performing another tracking task with the left hand while continuing to control with the right, doing mental arithmetic while controlling, etc.

All but one form of stress degraded the performance of both systems but the important finding was that performance of the system in which minimization was employed, i.e., that one requiring only simple human behavior, degraded far less than the system which demanded more of the man. This was true with every stress task that had any effect upon performance. Thus, we see that there is a possibility of countering man's tendency to unreliability by proper system design.

Exercising. A second technique for dealing with the operator's natural unreliability is to build into the space craft exercising devices. If the space pilot travels for many months or years between landings, he may forget the skills which he needs to effect re-entry and descent. Our solution to this would be to carry along training devices or simulational equipment on which the operators could practice re-entry and other needed skills while traveling through space. Space-borne trainers are one type of exercising device.

A less obvious application of exercising is in maintaining human alertness during the performance of routine and boring tasks. It is likely that space pilots will spend a great deal of time doing nothing more than monitoring and checking their instruments. Hopefully, nothing will go wrong, yet should it, it is essential that the emergency be immediately recognized.

Research has shown that in monitoring tasks where signals for action rarely occur, human alertness suffers. The length of time it took subjects to detect an emergency signal appearing at random on one of 8 dials over the course of a 2-hour watch has been plotted. The subjects never received more than four signals throughout the whole time (2.5 per 2 hours) and they never knew when to expect them. If a signal came during the first half hour it took 2.5 seconds to detect it. If a signal appeared in the second half hour it took between 6 and 7 seconds to catch it. In the third half hour the time rose to 8.5 seconds. The final improvement in performance was due to the motivation supplied by the knowledge that the watch was soon coming to an end.

Is there anything which can be done to prevent this drop in alertness during the middle portions of a watch? Yes! One thing we now know will prevent it is to throw in artificial signals which the subjects must respond to along with the real. The lower curve shows what happened to the same subjects when 120 artificial signals were thrown in at random during the 2-hour periods. The points in this curve (illustrated by slide) still refer to the time required to detect the few real emergency signals that appeared. Obviously, the subjects were much more alert throughout the watch and no slump occurred in the middle of the monitoring period.

In this study, the artificial signals were identical with the real emergencies, but we now know this is not necessary. In subsequent experiments, we have shown that a blinking light or a tone are just as effective signals for keeping the subjects alert to emergencies appearing on the dials as the type of artificial signal used in this experiment.

The study suggests that a simple exercising device which randomly generates buzzer signals to be turned off by the operator might be used aboard a space vehicle to hold human alertness at peak levels over extended watch periods.

SPEAKER: ***Maj. J. A. Steele, Wright Air Development Center, Wright Field***

MY EXPERIENCE pertinent to this subject has been mainly with detecting and counteracting sources of man's unreliability in flight. Historically aviation medicine has worked backwards. What is the cause of death? In this way was discovered the need for oxygen at altitude, the need for visual orientation. protection against high acceleration, and the reduction of cockpit complexity. Had technology developed differently, the Van Allen radiation belt might have been named for a physician rather than a physicist. It was an unanticipated potential "cause of death."

The leisurely approach of man to space has allowed adequate time to anticipate and study possible hazards: closed environment, radiation, vibration, acceleration including no acceleration and isolation. These problems may all be solved by protection, selection and training. Man in space will function.

But what can he do? Specifically what can he contribute to the reliability of his space transportation. The basic source of unreliability in weapons whether manned or unmanned is the performance of the electronics. The major cause of missile failure in electronics is small signal modulation (microphonics) and physical failure due to vibration. Man aboard can do nothing to prevent this. He receives his information and exercises his control through those same fallible systems.

There are, however, things that only a man can do. Things other than guiding the takeoff. For these tasks we must include a little man in the system. However, a minimum man in space weighs about one ton. Judging by the standards of present satellites and the micromodules under development, that is a lot of equipment. It could represent a lot of increased reliability.

When first introduced into the space system the man may well reduce its reliability by displacing equipment. When vehicles are large enough to take advantage of man's flexibility, he may be able to compensate for some equipment failure if the equipment has interchangeable parts, and functions and is accessible.

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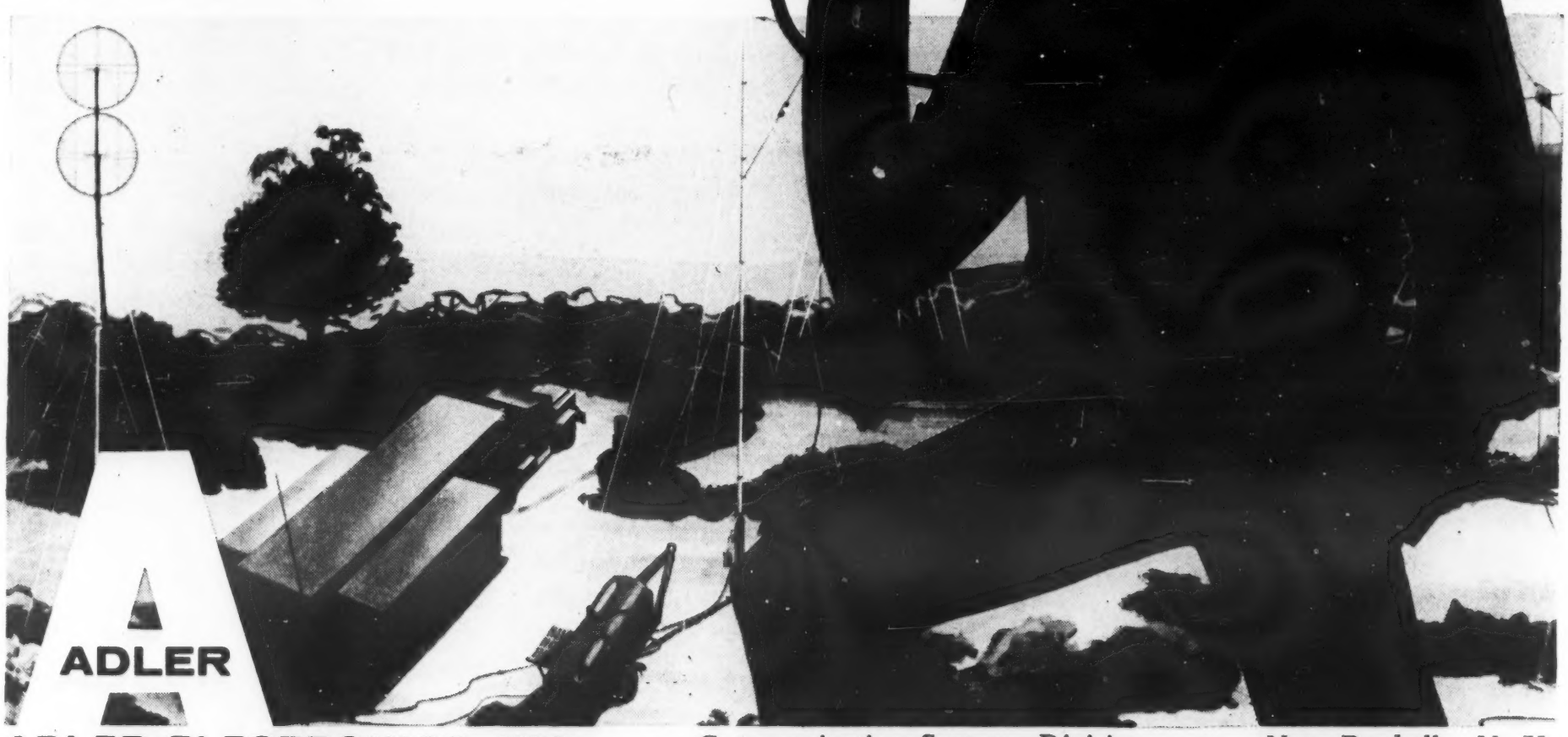

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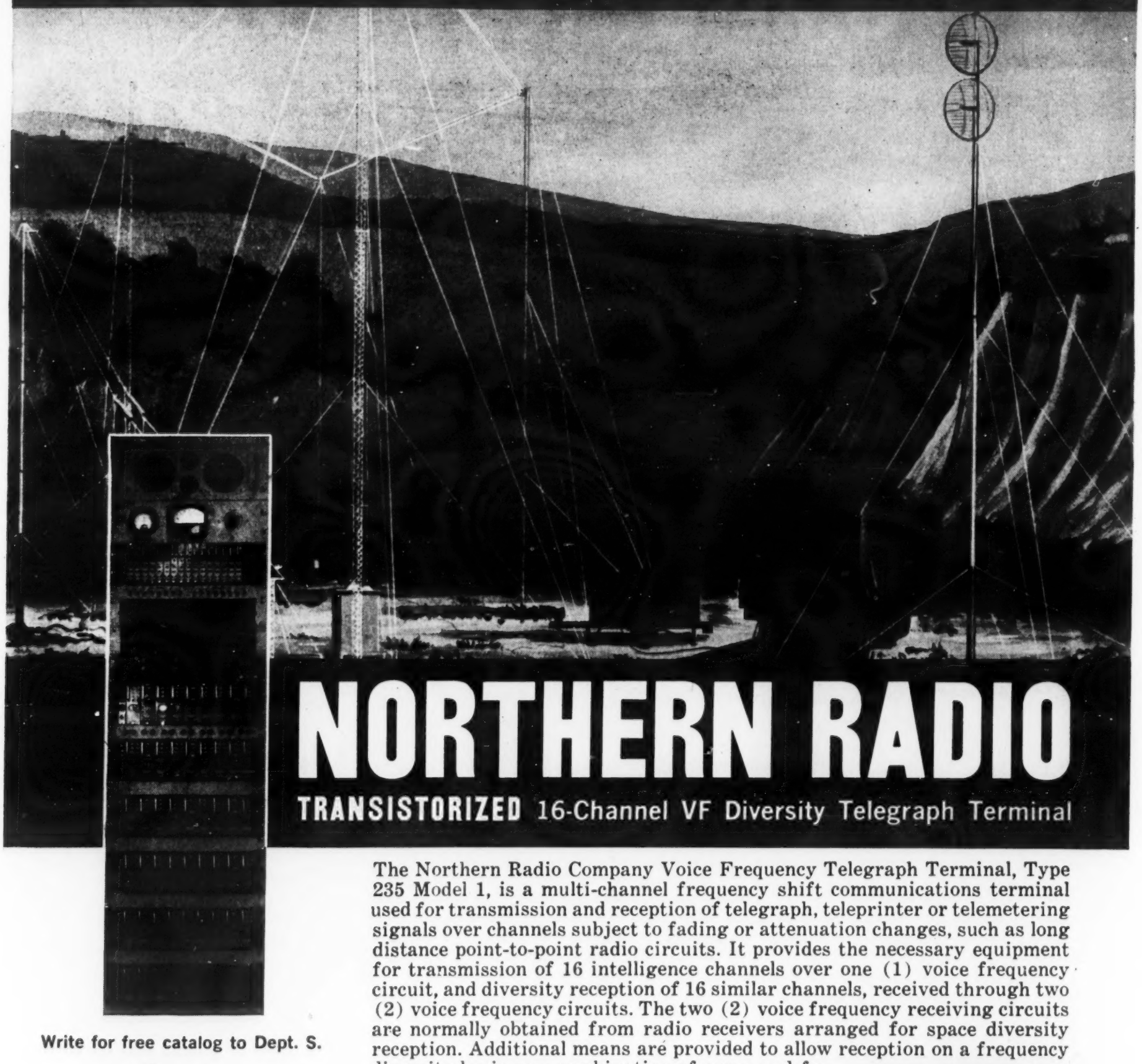
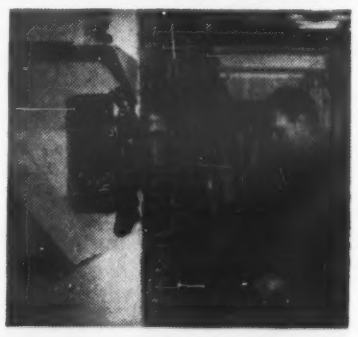


NORTHERN RADIO

TRANSISTORIZED 16-Channel VF Diversity Telegraph Terminal

The Northern Radio Company Voice Frequency Telegraph Terminal, Type 235 Model 1, is a multi-channel frequency shift communications terminal used for transmission and reception of telegraph, teleprinter or telemetering signals over channels subject to fading or attenuation changes, such as long distance point-to-point radio circuits. It provides the necessary equipment for transmission of 16 intelligence channels over one (1) voice frequency circuit, and diversity reception of 16 similar channels, received through two (2) voice frequency circuits. The two (2) voice frequency receiving circuits are normally obtained from radio receivers arranged for space diversity reception. Additional means are provided to allow reception on a frequency diversity basis or a combination of space and frequency diversity may be used for maximum reliability, when conditions are such as to require same.



Write for free catalog to Dept. S.

NORTHERN RADIO CO., INC.

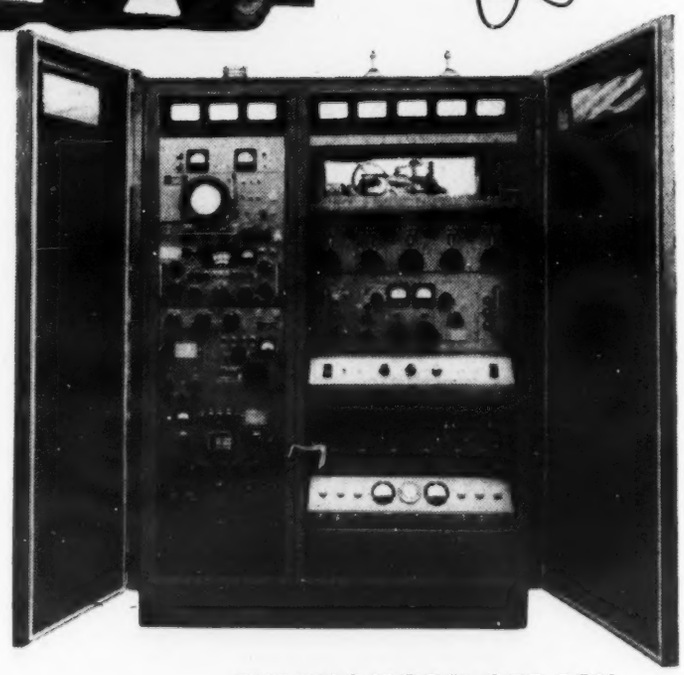
Pace-Setters in Quality Communications Equipment

147 West 22nd Street, New York 11, N. Y.
In Canada: Northern Radio Mfg. Co., Ltd., 1950 Bank St.,
Billings Bridge, Ottawa, Ontario.

AN/TSC-16

COMMUNICATIONS CENTRAL

The Technical Materiel Corporation congratulates the U.S. Army Signal Corps and Adler Electronics upon the successful development and production of the AN/TSC-16 Air/Ground Transportable Long Range Communications Van. We feel that the existence of this system further signifies the ability of the Armed Forces and Industry to cooperate rapidly and efficiently to produce advanced equipment for America's security. We are proud to have been one of the major subcontractors. The GPT-10K (AN/FRT-39) is the basic 10 KW SSB Transmitter used in the AN/TSC-16 .



THE TMC MODEL GPT-10K, Radio Transmitter is a conservatively rated general purpose unit capable of providing 10 kw PEP output throughout the range 4 to 28 mc. The Model GPT-10K also provides operation on CW, MCW, SSB, ISB, DSB, FS. Full details available in Bulletin 207B.

The TECHNICAL MATERIEL CORPORATION

IN CANADA
TMC Canada Ltd. Ottawa, Ontario

Main Office MAMARONECK NEW YORK

Communications & Civil Defense

(*Continued from page* 31)

It will be policy control—certainly not operational control. It is abundantly apparent that the common carriers are the only entities physically capable of operating the vast communication networks of the country. Government agencies and private individuals will continue to operate facilities and stations, subject to the requirements that are dictated by the interests of national security. The basic task of the Administrator will not be to operate facilities, but to apportion and allocate service in the national interest.

Our plans in OCDM have been concerned largely with three aspects of the telecommunications resource:

First, to establish the structure of the organization considered necessary to control the use of the resource;

Second, to make provision for the continuity of telecommunication policy and management;

Third, to plan for those emergency actions considered necessary in maintaining the flow of national telecommunications.

We are well aware of additional problems that will arise. Although we can visualize some of the consequences of an attack, we know also that we cannot predict every eventuality. In this knowledge we have planned for the establishment of a field organization for the Emergency Agency. Details of the plan have not as yet been completed. However, we are aware of the need for trained, experienced people in the field—people who are qualified to make on-the-spot judgments of the situation and to make the correct decisions in the light of national interest. During peacetime most of the field people will be members of the National Defense Executive Reserve. We realize that we have a sizeable job ahead in recruiting qualified people and establishing an orientation program that will prepare them to assume their responsibilities if an attack should come. This program should get underway in the coming fiscal year.

The problem of building a strong military force and an effective non-military defense is one of tremendous magnitude. The course of civilization was once described in these words:

"Human history becomes more and more a race between education and catastrophe."

The outcome of that race might well be decided by the degree of effectiveness of our military and non-military preparedness.

Another Nationwide Tribute

(*Continued from page* 27)

workable telegraph, so other men now struggle with bands of radiation and nuclear power, and sensitive rockets of almost indescribable power.

And man, who faced the terrors of the unknown in other parts of his sparsely inhabited planet, now faces the terrors of the unknown in his sparsely settled solar system.

But so rapid has been man's assault on the problems of space that the average man-on-the-street would lose the quiz contest prize if asked to recite how many earth satellites are still cruising above him. But he needn't blush. We've encountered so-called experts who can't remember which went up when or what it's doing there!

And frankly neither can I. As a mere newsman, standing off to the sidelines and every bit as impressed as the open-jawed yokel, I can't for the life of me keep up with the avalanche of technical material that finds its way to my desk. And I exult in the fact that I can't. For that's proof, to me, that our scientists and engineers and inventors are working at practically assembly-line speed to produce a better world for the likes of me.

After a lifetime devoted to chronicling the fortunes and the foibles of my fellow man, I find that there is always room for new thrills. For the technical experts who can sometimes write such dry papers keep producing such glamorous things that the most naive bumpkin can comprehend!

Once man knew the world was flat, else why would he not fall off the side of it? And then he learned it was round, and later, that it was really pear-shaped. If tomorrow they tell me that the world is really a pretzel but shaped more like a mug of beer, I'll buy that too, for I can't design an earth satellite or fathom micro modules or poke my head inside a telemetry complex and begin reciting its anatomical alphabet. But I can appreciate progress when it's properly explained to me. And so can the American people who not only expect it from their leaders, but demand it. And perhaps it is a good thing that they do, for pressures, to create, or advance, or beat out the other competitor or competing nation, have helped increase the flow of progress in this land of competition and rivalry.

It's been said that if Marconi hadn't invented the wireless, or Sperry his gyroscopic compass, or the Lumières their autochrome process of color photography, Joe Doakes would have done it a short time later. And it's probably true. But we can't help keeping a special place in our hearts for the first ones—the men who were radical in their youth—and revered in their dotage—or who sometimes had to wait until they had piled up impressive seniority in the graveyard before their fellow man could properly assess the value of their contribution to the stream of life.

These were and are the doers. And if people in the news business can appreciate them perhaps a tiny bit more than the average layman, it's partly selfish. It is the doers who keep us newsmen beating on typewriters and skipping a step or two ahead of the mortgage company.

They make possible and lively our professional lives, and at the same time they enrich our personal lives.

The men we know in the AFCEA qualify as doers, and their record speaks for itself. Their Association, made up of top leaders of American business and industry and key personnel of our Armed Services, concerned with the complex fields of communications, electronics and photography, has shown the way to better, more rapid progress.

Electron microscopes, thermal photography, weapons control systems, auroral physics, jet stream research, radar, air control systems, electronic brains—these are but a handful of gimmicks they devise and control and turn into slaves for the use of their fellow man. And they are not without their rewards. But the true satisfaction—in doing the job well, in getting it done on or ahead of schedule or giving just a bit more than was asked—lies inside the doer himself. You can't spell it out on a check, or mold it into a golden statuette, or carve it in stone and put it in a park to delight the pigeons. It's something deep inside the doer. Perhaps it's called achievement—or patriotism—or pride. We don't quite know. But it's the stuff that keeps the doers doing, producing, contributing, advancing ever forward, relentlessly, over and through that wall of ignorance that separates Man from God.

The doer is meeting the test mighty well these days. Don't let the pessimists ever delude you. Man is bumping his head on the stars while some of his fellow men in Africa and the Australian outback are still residing in the Stone Age. We don't know where we're going, but we *are* going . . . and as someone once said, "Perhaps success is the journey . . . not the destination!"

AFCEA

1624 Eye Street, NW
Washington 6, D. C.
Phone: EXecutive 3-3033

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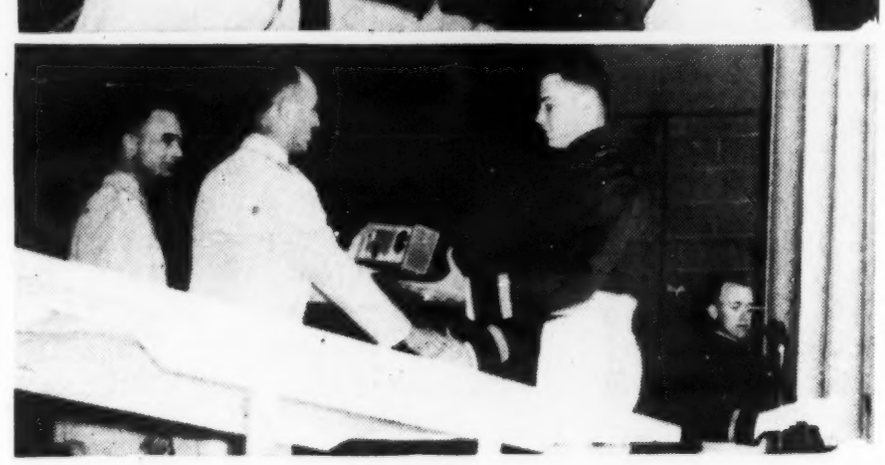
The President, the immediate Past President, the Vice Presidents and the Counsel are ex-officio members of the Board of Directors.
**Executive Committee Member.*

Association affairs

Academy Awards



AFCEA's awards to the Military, Naval and Air Force Academies this year consisted of portable transistor radios donated by Sylvania Electric Products, Inc.

(Top) West Point Cadet Arthur S. Kubo, who had the highest average in electrical engineering, receives the award from RAdm. Frederick Furth. (Middle) For highest merit in the electronics course, Midshipman Richard W. Laton is presented the award by RAdm. Frank Virden. (Bottom) Air Force Cadet Joseph D. Morgan, III, outstanding in electrical engineering, is presented the award by Maj. Gen. Gordon Blake.

New Group Members

William C. Copp & Associates

William C. Copp & Associates, SIGNAL's Advertising Representative, has become a group member.

AFCEA representatives are: W. C. Copp, L. Petranek, H. A. White, D. M. Jones, J. S. Spargo, H. A. Rose, H. R. Keays, T. W. Redston, M. R. Munk, R. Schoonover, L. Fernandez, S. Kingwill, Jr., P. Schulz and D. A. Scott.

Servo Corporation of America

Servo Corporation of America, New Hyde Park, N. Y., an electronics firm, has become an AFCEA group member.

AFCEA representatives are: H. Blackstone, President; A. Freed, Marketing-Vice President; J. Cardon, Weapons Sub-Systems Manager; J. Fitzgerald, Weapons Sub-Systems Asst. Manager; P. Hansel, Chief Radio Engineer; J. Statsinger, Engineering Vice President; S. Levine, Government Sales Manager; E. Ryan, Salesman; W. Campbell, Advertising Manager; F. Tressa, Radio Engineer.

Teleprinter Corporation

Teleprinter Corporation, a manufacturer of printing telegraph equipment, has joined the AFCEA group membership. The company is located in Paramus, N. J.

Company representatives include: R. J. Blinken, President; B. Howard, Vice President and Chief Engineer; R. M. Hirsch, Vice President and Director of Systems; A. Lindan, Controller; E. A. Judd, Purchasing; C. A. Rudd, Chief Electrical Engineer; G. A. Foerster, Chief of Testing; M. H. Blinken, Board Chairman.

As we go to press, McCoy Electronics Co. has become a group member. The September issue will list the company representatives.

NEW MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of June. Members are listed under the Chapter with which they are affiliated. The July listing will appear in the September issue.

ARIZONA

W. E. McCollum

AUGUSTA-FORT GORDON

Aubrey C. Brooks
Capt. Nelson A. Lecklikner
Maj. Rufus E. Hunt
Richard B. Sheridan
Maj. William B. Buckner, Jr.

BALTIMORE

Frederick W. Denniston
J. W. Colvin
J. M. Beggs
Thomas J. Carroll
Arthur W. Plummer

BOSTON

Lt. Col. Richard M. Osgood
Raymond D. Griffiths
Harold E. Patterson
Martin Cooperstein
Richard D. Evans
Ralph J. Summers
Arthur B. Sperry
Jay T. Thomas
Melvin E. Lowe
Victor P. McDavitt
Clarence M. Jepson
Robert W. Cove
Lt. Alvan G. Smith, Jr.

CHICAGO

Lawrence S. Burchett
Arthur L. Vlcek
Frank Richey
Warren S. Laird, Jr.
Charles W. Jenkins
M-Sgt. Elizabeth E. Stapleford
C. I. Wright
C. F. Ffolliott
O. L. Smythe
Lt. Cdr. Edward J. Piggott
Harold Harris
Maj. Milton D. Norstrom
Leslie E. Barnett
John H. Adams
R. Strimling
Sgt. Robert W. Hartman

DECATUR

Robert G. Woodcock

FORT MONMOUTH

Hal V. Miller
John R. Andrews, Jr.
Dexter Marcum
Lawrence F. Dennis

GULF COAST

M-Sgt. Amos C. Lashley
Gustave F. Last
S-Sgt. Charles A. Stutz
S-Sgt. Allan L. Hopper
S-Sgt. George McGrevey
S-Sgt. Willie H. Albritton
A-2C Carl R. Brunelle
S-Sgt. Verlin C. Harmon, Jr.
A-1C Edward P. Holbrook
A-1C Justin L. Hall
S-Sgt. Frank A. Wright
T-Sgt. Richard D. Roark
T-Sgt. Richard G. Bujak
M-Sgt. John W. Hearty, Jr.
A-2C Walter R. Bernadzikowski
M-Sgt. William L. Rice
A-2C George L. Franch
Capt. Glen T. Emmons

KANSAS CITY

Joseph F. Baremore
Robert B. Uhrig

LONDON

Cdr. Richard W. Hyde
Kenneth G. Smith
Herbert T. Clayton
Lt. Gerard P. O'Neill

LOUISIANA

Phillip J. Boogaerts

NEW YORK

Elston H. Swanson
Robert C. Lockwood
Eugene B. Novikoff
John T. Daley
John S. Crum
Robert D. Billhimer
John J. A. Michel
Lawrence I. Algase
Ira Goodman
Arnold X. Rubin
John J. Medico, Jr.
James McGuire
Edward L. Schneider
Robert J. Blinken
Howard Bernard
Lt. Cdr. Ralph M. Hirsch
Arthur Lindan
Edward A. Judd
Chester A. Rudd
G. A. Foerster
M. H. Blinken
Maj. Otto J. Nowak
Robert A. Aram
Anthony R. Pignoni
Dominick R. Casale
R. J. Gilman
E. G. Gilbert
Henry H. Emker
R. H. Denton
Charles Higgens
George King
Richard Treible
E. H. Schober
Kenneth Shay
H. Blackman
Perry J. Wilson
T. O. Odom
John S. Auld
Antone S. Pimentel
James M. Valentine
Patrick A. Fraioli
John J. Root
Adolph M. Gluck
Tsen Cha Tsao
James E. Halsted
James J. Leonard
R. E. McIlvane
C. G. Creal
Lt. Col. Thomas E. Pynn
Paul A. Reveal
Edward J. Keiper
Irving von Zelowitz
John P. Carr
William H. Coffey
Harry A. Kohler

NORTH CAROLINA

Lt. Thomas C. Nelson

NORTH TEXAS

Cdr. Ronald R. Reiland

ORANGE

H. Carlisle Dent

PARIS

Guy Bremeau

PHILADELPHIA

William C. Bainbridge
Sy Hochman
Robert Vendeland
Joel Morris
G. P. Bieging
Richard E. Smith
Joel N. Bloom
Ezra S. Krendel

ROCKY MOUNTAIN

Henry C. Mulberger

ROME-UTICA

Lt. (j.g.) Colin W. Getz
Sanford J. Cohm
Sidney A. Mills
C. R. Wayne

SAN DIEGO

R. W. Trulock

SAN FRANCISCO

Elmer Metz
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SAN JUAN

Gregory F. Rocha, Jr.
Juan M. Torres
Manuel Angueira Rodriguez
Augusto Alvarez
Maximino Moreno

SANTA BARBARA

Joseph J. Sayovitz
Dr. Fritz K. Feldman
Lloyd T. Devore
Lloyd Jones
Larry S. Smith
George A. Knudsen

SCOTT-ST. LOUIS

Lt. Col. William F. Tucker
F. B. Hunt

SOUTH CAROLINA

Ernest K. Hesse
Guerry R. Thornton

SOUTH TEXAS

Maj. August Esenwein, Jr.
Kenneth D. Smith
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John R. Griggs
Harry Gross
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Col. Ellis E. Eno
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James G. Russell
Lt. Col. Neal A. Jolley
Paul Boggess
F. W. Lynch
George Crane
Burton Cutler
Alan McClelland
Edward A. Stearn

TOKYO

Koji Kobayashi
Maj. Erwin J. Kaidy
Lawrence E. Hoffman
Stanley A. Cable
Carl W. Stickney
Col. John Crawford

WASHINGTON

John J. Londis
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John W. Forss
Gabriel C. Danch
Cdr. Frank H. Cunnare
J. Pell Miller
Col. Robert F. Sladek, Sr.
Col. Erle H. Pike
William B. Sturtevant
Cdr. William F. Potter
Lt. Cdr. Frank F. Merrill
Richard B. Nichols
Maj. Chester A. Dillahunt
Donald F. Bryan
Stuart A. Pettingill
Maj. Joseph C. Gurley
Henry R. Clum
Edward A. Hunter
Aber H. Dearfield
William E. Stuart-Donathan
Cdr. Ugo Pizzarelli
Leon H. King
Z. V. Grobowski
Lt. Col. John E. Pascoe
R. R. Mallory
Kalla L. Abrahams

New members without chapter affiliation.

Cdr. John H. Bruning, Cincinnati, Ohio
Curtis C. Bogart, Holcomb, N. Y.
G. A. Rutenbeck, Milwaukee, Wisconsin
Col. Robert R. Velie, Charleston, West Va.
Lt. Charles J. McDonald, Jr., FMFPAC, FPO, S. F.
W. D. Wright, Indianapolis, Ind.
C. Zollinger, Indianapolis, Ind.
C. A. Anthony, Indianapolis, Ind.
D. J. Hargadon, Indianapolis, Ind.
J. W. Quinlan, Indianapolis, Ind.

AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security.

Sustaining Member

Cook Electric Co.—Transferred from Group Member March 18, 1959.

Acme-Danneman Co., Inc.
Adler Electronics, Inc.
Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Amphenol/Borg Electronics Corp.
Anaconda Wire & Cable Co.
Andrew Corp.
Arnold Engineering Co.
Atlas Film Corp.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Beiser Aviation Corp.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Convair, Division of General Dynamics Corp.
William C. Copp & Associates
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Designers for Industry, Inc.
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
Du Mont. Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp
General Analysis Corp.
General Aniline & Film Corp.
General Communication Co.
General Electric Co.
General Electric Co., Defense Systems Dept.
General Telephone & Electronics Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
William F. Hogan Associates, Inc.
Hughes Aircraft Co.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
Instruments for Industry, Inc.
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
International Telephone & Telegraph Laboratories
ITT Federal Division of International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Jerrold Electronics Corp.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Leich Sales Corp.
Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Litton Industries, Inc.
Lockheed Aircraft Corporation
Machlett Laboratories, Inc.
Magnavox Co.
Marconi's Wireless Telegraph Co. Ltd.
Materiel Telephonique Co.
McCoy Electronics Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
National Co., Inc.
Nelson Technical Enterprises, Inc.
Nems-Clarke Co., Div. of Vitro Corp. of America
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
New York Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Electronics Corp.
Page Communications Engineers, Inc.
Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
Plessey Co., Ltd.
Prodelin Inc.
Radiation, Inc.
Radio Corporation of America
Radio Corporation of America, Astro-Electronic Products Div.
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
Radio Frequency Laboratories, Inc.
Ramo-Wooldridge, Division of Thompson Ramo Wooldridge Inc.
Raytheon Co.
Red Bank Division, Bendix Aviation Corp.
Reeves Instrument Corp.
Rocke International Corp.
Saxonburg Ceramics, Inc.
Scanner Corporation of America, Inc.
Servo Corporation of America
Singer Manufacturing Co., The Military Products Division
Smith-Corona Marchant Inc., Research and Development Division
Society of Motion Picture & Television Engineers
SoundScriber Corp., The
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Telephones & Cables, Ltd.
Stanford Research Institute
Stewart-Warner Corp.
Stoddart Aircraft Radio Co.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products, Inc.
Technical Materiel Corp., The
Tele-Dynamics, Inc.
Telephonics Corp.
Teleprinter Corp.
Teletype Corp.
Texas Instruments, Incorporated
Times Facsimile Corp.
T.M.C. (Canada) Ltd.
Transitron Electronic Corp.
Trans-Sonics, Inc.
Tung-Sol Electric, Inc.
Union Carbide Corp.
United Telephone Co.
United Transformer Co.
Van Norman Industries, Inc., Electronics Division
Varian Associates
Waterman Products Co., Inc.
Webcor, Inc., Government Division
West Coast Telephone Co.
Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
Wollensak Optical Co.
Zenith Radio Corp.

Photostat machines, factory assembled, are protected and secured for safe shipment UNCRATED. Roy Williamson reports no major damage to any unit during four years of North American padded van service.

How Photostat Corporation solved a problem... by shipping UNCRATED in NORTH AMERICAN VAN LINES' PADDED VANS

According to Roy Williamson, Traffic Manager for the Photostat Corporation, Rochester, New York, their problem was to make fast and safe delivery of factory-assembled photocopying machines—ready for use upon arrival.

North American Van Lines had the answer: ship the assembled machines UNCRATED in special padded vans. Delivery is made directly into the office where it is to be used—and a local Photostat representative quickly makes the few simple adjustments required. As a result, the customer is happy with a machine ready for use—and there are savings in both time and labor.

If *you* have a shipping problem, it will pay you to get the first-hand facts about North American Van Lines' padded van service. Write or phone today.

North American
WORLD-WIDE MOVING
LAND · SEA · AIR

NORTH AMERICAN VAN LINES, Inc. / World Headquarters / Dept. 19-3 / Fort Wayne, Indiana
In Canada, North American Van Lines Canada, Ltd., Pickering, Ontario ... In Europe, North American Van Lines Europe, GMBH, Mannheim, Germany

AFCEA Group Members

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American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Amphenol/Borg Electronics Corp.
Anaconda Wire & Cable Co.
Andrew Corp.
Arnold Engineering Co.
Atlas Film Corp.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Beiser Aviation Corp.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Convair, Division of General Dynamics Corp.
William C. Copp & Associates
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Designers for Industry, Inc.
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
Du Mont. Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp
General Analysis Corp.
General Aniline & Film Corp.
General Communication Co.
General Electric Co.
General Electric Co., Defense Systems Dept.
General Telephone & Electronics Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
William F. Hogan Associates, Inc.
Hughes Aircraft Co.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
Instruments for Industry, Inc.
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
International Telephone & Telegraph Laboratories
ITT Federal Division of International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Jerrold Electronics Corp.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Leich Sales Corp.
Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Litton Industries, Inc.
Lockheed Aircraft Corporation
Machlett Laboratories, Inc.
Magnavox Co.
Marconi's Wireless Telegraph Co. Ltd.
Materiel Telephonique Co.
McCoy Electronics Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
National Co., Inc.
Nelson Technical Enterprises, Inc.
Nems-Clarke Co., Div. of Vitro Corp. of America
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Pacific Telephone & Telegraph Co.
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Photographic Society of America
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Prodelin Inc.
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Radio Corporation of America
Radio Corporation of America, Astro-Electronic Products Div.
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
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Scanner Corporation of America, Inc.
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Chapter News

Augusta-Ft. Gordon

At the June 18th meeting at Buck Lodge, the Augusta-Ft. Gordon Chapter presented its annual Science Senior Award to North Augusta High School graduate Richard B. Sheridan. Colonel Robert R. Creighton, Assistant Commandant of the Army's Southeastern Signal School and Chapter president. made the presentation.

The award is conferred yearly on an outstanding graduate of a Central Savannah River Area high school who plans to continue his education in the fields of science and engineering. This year's award consisted of a grant of $250 and a student membership in the Association.

Young Sheridan. unable to attend West Point because there were no openings at the Academy, will begin his college work at the University of South Carolina.

Baltimore

New officers and directors were installed at the meeting on June 13th. They are: president—J. Walter Colvin, Bendix Radio Div., Bendix Aviation Corp.; executive vice president—Cdr. Bob Kirsten, USCG; vice president—(program)—Col. Riley A. Graham, USA; vice president—(membership)—Adam A. Fiedler, Bendix Radio Div., Bendix Aviation Corp.; secretary—Ray Moore, Hoover Electronics; treasurer—Thomas E. Thompson, The Martin Co.

The directors are: Trevor Clark, Westinghouse Electric Corp; A. E. Abel, Bendix Radio Div., Bendix Aviation Corp.; B. M. Brown, Westinghouse Electric Corp.; Charles Eagswell, Thompson Trailer Corp.; J. Walter Colvin, Bendix Radio Div., Bendix Aviation Corp.; Capt. V. E. Day, USCG; Charles W. Hoos, Chesapeake & Potomac Telephone Co.; J. Jacobsen, Aircraft Armaments; E. K. Jett, USMAR; Al Novak, Hoover Electronics; John Pearce, The Martin Co.; J. Walton.

LONDON—Pictured at the formal dinner dance are (l to r): Maj. F. S. Puente, USAF, Mrs. Puente, Mrs. E. B. Parsons and Maj. E. B. Parsons, USAF.

London

The semi-annual Ladies' Night and formal dinner dance was held at the Columbia Club Hotel, May 14. 180 members attended the event.

Election of officers will take place at the next meeting, which will be a general business meeting.

Louisiana

The Alvin Callender Field at the Naval Air Station, Belle Chasse, Louisiana, was the scene of the Chapter's June 23rd meeting. Dr. Homer L. Hitt, Dean of Louisiana State University in New Orleans, addressed the chapter meeting on "The Past, Present and Future of L.S.U. in New Orleans."

Officers for the year 1959-1960 were elected at the meeting and will be reported in a later issue.

New York

"Color TV Development in the Soviet Union and Other Countries" was discussed by J. Raymond Popkin-Clurman, founder and President of Telechrome Manufacturing Corp., at the May 27th meeting held at the Belmont Plaza Hotel.

Mr. Popkin-Clurman, who represented the United States at a meeting in Moscow of the International Radio Consultative Committee, stated that Russia has spent much money but has not developed personnel qualified to operate a TV system. He further noted that color TV may force a standardization of all TV in Europe and eliminate the present eleven different systems.

Paris

Rear Admiral H. C. Bruton, Director of Communications and Electronics. Headquarters EUCOM, has been elected president of the chapter for 1959-60.

Admiral Bruton, former Director, Naval Communications, served as a National Vice President of the AFCEA from 1955-1958.

Pittsburgh

New officers recently elected are as follows: president—E. M. Kliment, Western Union Telegraph Co.; vice

NEW YORK—J. Raymond Popkin-Clurman, founder and President of Telechrome Manufacturing Corp., addresses the Chapter on "Color TV Development in the Soviet Union and Other Countries" at the Belmont Plaza Hotel.

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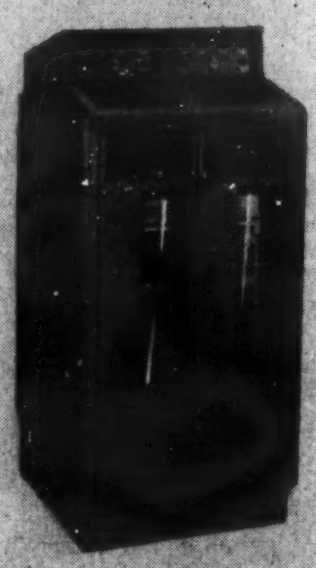

Model 28 RT Sets may be mounted in pairs in this newly designed Teletype Universal Cabinet, ideal for office or communications center installation.

New Teletype Model 28 RT Set

The Teletype Model 28 Reperforator Transmitter-Distributor Set features three automatic data handling facilities in one unit. It combines: (1) a typing or non-typing TAPE PUNCH . . . with (2) a TAPE READER . . . plus (3) intermediate TAPE STORAGE facilities.

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Automation. For automatic linkage between incoming control data and signal-operated factory equipment . . . for automatic relaying of telemetered data over communication lines.

Speeds from 368 to 1,200 characters per minute are available for 5-level code. A manual gearshift permits selection of 368, 460 or 600 operations per minute with either typing or non-typing tape punches. Units with non-typing tape punches operate at 1,200 operations per minute with a fixed gear arrangement.

If you would like more information about this new and versatile Teletype unit, please write for descriptive literature to: Teletype Corporation, Dept 73H, 4100 Fullerton Ave., Chicago 39, Illinois.

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Rome-Utica

Angus A. MacDonald, Director of Engineering, Motorola Inc., discussed "Engineering Management" at the May 20 dinner meeting at Club Martin. Mr. MacDonald's talk centered around the differences between military and commercial engineering management.

Officers for the following year elected at the meeting are: president—Murray Socolof; first vice president—Lt. Col. Michael Bobela; second vice president—Albert F. Wilde; third vice president—Maj. Joseph R. Bernard; secretary—Robert Weil; treasurer—John J. Ward. Charles A. Strom was named permanent chapter historian.

Elected to the board of directors were Maj. Gen. Clyde H. Mitchell, Brig. Gen. Donald P. Graul, Brig. Gen. Haskell E. Neal, William L. Roberts, Allan A. Kunze, Richard C. Benoit, Fred May, Albert D. Reisenberg, Daniel Brendiar, Col. Otto G. Quanrud, Col. Alan V. Rochford and Charles W. Gordon.

At the June 17th meeting Allan A. Kunze, senior scientist with the Directorate of Communications, Rome Air Development Center, received the AFCEA "man-of-the-year" award for the Rome-Utica Chapter. Mr. Kunze was cited for his outstanding contributions to AFCEA, for his efforts in fostering a better understanding between government and private industry and for his personal contributions in promoting an active and effective program in the Chapter.

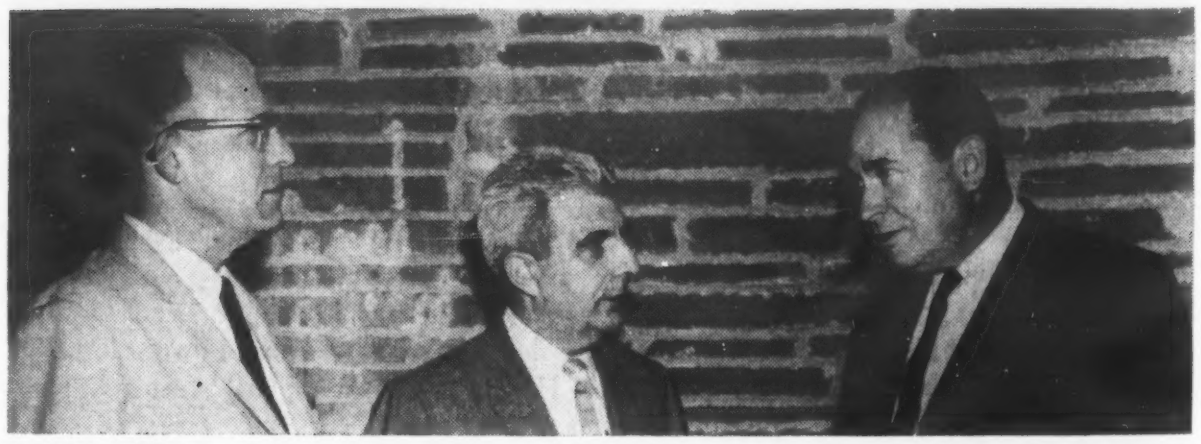
Addressing the last meeting of the season, Thompson H. Mitchell, President, RCA Communications Inc., reviewed some of the major problems presently confronting the American international communications companies as a result of competition, coupled with government regulation.

Seattle

Prater Hogue, Aircraft Safety Specialist for the Boeing Airplane Co., addressed the May 13th meeting held at the Benjamin Franklin Hotel. Mr. Hogue noted that Boeing's first transport, the Model 40, made a record-breaking flight to Portland, Ore., in the same elapsed time that the new jet transport, the Model 707, can fly all the way to San Francisco. The time was one hour and forty-nine minutes. Mr. Hogue centered his remarks around the background and history of the Boeing Airplane Co.

At the June 10th meeting the following officers were elected: president—Cdr. Leo Larkin; vice president—Roy Pace; secretary—J. Alan Duncan; treasurer—Gene Gunther.

Cdr. J. Greksouk, USN, Radio Station, Jim Creek, was the guest speaker at the dinner meeting. Cdr. Greksouk told the group about the Jim Creek installation, discussed the layout of the installation and spoke of the effects of severe weather conditions.



ROME-UTICA—Left to right: Allan A. Kunze, winner of the Chapter's "Man of the Year" award; Murray Socolof, Chapter President; Thompson H. Mitchell, President, RCA Communications, Inc., and guest speaker for the evening.

South Carolina

The election of officers for the 1959-60 year was the main order of business at the chapter's annual ladies' night meeting held at Myrtle Beach Air Force Base on May 22.

E. D. Biggerstaff, Jr., Charleston Naval Shipyards, succeeds W. O. Kiger, Southern Bell Telephone Co., Columbia, as president. Other officers elected are: Lt. Col. R. J. Green, Shaw AFB, 1st vice president; H. L. Lackey, Southern Bell, Greenville, 2nd vice president, and D. D. Harris, Southern Bell, Columbia, secretary-treasurer. Raymond Sheehan, General Telephone Co., Sumter; Lt. Col. M. F. Crispen, Shaw AFB, and W. F. Reilly, Charleston Naval Shipyards, are members of the Board of Directors.

Sanford Marlowe, Assistant Program Manager, Voice of America, was the guest speaker for the evening. He discussed the programming, broadcasting and effectiveness of Voice of America programs.

"Obviously we can't take public opinion polls in the Soviet Union." he said in response to a question about the listening audience behind the Iron Curtain, "but one fact stands out, that is the jamming of our programs by the Soviet Union. Jamming is their attempt to make our radio signal unintelligible to the listener.

"We spend $16,000,000 a year on broadcasting world-wide. The least estimates are that the Soviet Union and its satellites spend over $100,000,000 a year to jam our broadcasts. It's hard to believe that the Soviet government would spend this much money if it didn't believe the people were listening to the Voice of America."

South Texas

A dinner meeting was held on June 11th at the Randolph Air Force Base Officer's Club. J. C. Barclay, Defense Communications Manager for American Telephone & Telegraph Co., was the guest speaker. He showed a film giving recently de-classified information on the operation of the SAGE System of Air Defense and explained the communications facilities required to implement the system.

Southern California

The annual dinner meeting of the Chapter was held on May 27 at the Statler Hotel. The main feature of the meeting was a talk by Rear Admiral J. P. Monroe, USN, on the Pacific Missile Range. Admiral Monroe is the Commander of this key Navy installation at Point Mugu, California.

SOUTH CAROLINA—Newly elected chapter officers (l to r): Lt. Col. R. J. Green, USAF, 1st V. P.; E. D. Biggerstaff, Jr., President; Lt. Col. M. F. Crispen, USAF, Director; D. D. Harris, Secretary-Treasurer.

NEWS ITEMS AND NEW PRODUCTS

Republic Aviation Corporation recently reported details of the first space-environment chamber capable of taking a human 150 miles above the earth into a simulated ionosphere.

The space chamber, according to a company spokesman, will be used to test space suits and to investigate the physiological and psychological reactions of man at those altitudes, at the same time developing materials and components for space vehicles.

At present, the highest man has been reported attaining, in simulation chambers, is a little more than 38 miles. One other chamber in existence is capable of testing materials and components at 85 miles. (At altitudes higher than 15 miles a man without proper equipment would die in a matter of seconds.)

The space chamber will be 14 feet in diameter and 30 feet long and will weigh approximately 30 tons. Specially designed pumps and other equipment will produce the ultra-low-pressures found in outer space. Inside, the chamber is divided into two separate areas. The main area, where a man will be tested, will be cylindrical, 26 feet long and 13 feet in diameter.

The chamber, which will be built by Tenney Engineering, Inc., will be installed in Republic's new $14,000,000 astronautics research center early in 1960. Its cost is estimated at $500,000.

Republic's research center, now under construction, will house seven specialized space laboratories and 400 scientists and engineers working on problems from satellites to manned interplanetary travel.

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A new waveguide quick disconnect, Model 3419, is now available from Aircraft Armaments, Inc., Cockeysville, Md. It is adaptable for use in making quick connections on all types of waveguide components (including most flexible waveguide applications) both in the laboratory and in the field.

This coupler adds very little to the size of the connection and is easily attached to a standard choke flange with two screws, offering the utmost in simplicity of operation. The coupler is designed to make a connection of two cover flanges as well as one of a choke and cover flange, which makes a nice finished appearance for front panel attachments. The unit is made of stainless steel and is made in two sizes, K-band and X-band waveguide.

• • •

Laboratory technique for a pocket-size infrared device for portable field use behind enemy lines and commando missions has been demonstrated by GB Electronics Corp., builders of guided missile antennas.

This minute infrared unit is capable of detecting enemy submarines, atomic installations, missile launching sites and underground industrial and military installations at great distances.

The solid-state device, powered by a small pen-lite battery, can be concealed in a pocket; it also fits neatly into the minimum space of a missile nose cone.

"The light weight, small size and reliability of this proprietary system will make feasible a series of monitoring satellites to keep a watchful eye on possible aggressive activity throughout the world," a GB Electronics spokesman said.

• • •

A 30-pound atomic clock described as so accurate it will neither gain nor lose one second in a thousand years is being developed for an orbiting satellite by Hughes Aircraft Company to give Einstein's general theory of relativity "the most searching check of its 43 years."

The prototype of this "Maser" (Microwave Amplification by Simulated Emission of Radiation) clock is being constructed at the Hughes research laboratories at Culver City, Cal., under a $200,000 development contract from the National Aeronautics and Space Administration, it was announced by Dr. Harold Lyons, head of the Hughes atomic physics department and inventor of the world's first atomic clock. He said this clock is expected to provide "the most precise check in the history of the world on the effects of gravity on atomic processes."

"Scientists agree that stronger proof of the relativity theory is needed," Dr. Lyons said. "An atomic clock in orbit could support Dr. Einstein's revolutionary contributions and spur much significant scientific work."

A satellite clock's primary purpose will be to check Einstein's proposition that a clock running in a different gravitational field above the earth would apparently run fast relative to a clock on the ground.

However, Dr. Lyons said, the Hughes-proposed clock, without additional satellite-borne equipment, also would: (1) Recheck Einstein's special law of relativity which sets forth the famous "twin paradox." (The orbited clock would return 'younger' than its counterpart on earth and if a human twin could be launched with the clock, he would return younger than his brother who stayed home. If he could travel 20 years at near enough to the speed of light, or 186,000 miles per second, he would find the earth millions of years older when he returned.) (2) Precisely measure the geometric shape of the earth, even over inaccessible territory. (3) Investigate whether space is the same in all directions. (4) Measure the velocity of light or radio waves.

• • •

A new automatic wire straightener, stretcher and cutter of fine wire to pre-set lengths has been announced by Thomas Instrument Co., manufacturers of TI-CO Products, Phoenix, N. Y. Operated by a ratiomotor, this quiet, rugged, bench-type machine works at a rate of 2280 pieces per hour of 3¾" long #36 wire. The machine can also be manufactured to cut different lengths and to operate with various size wire. The machine dimensions are: 10" deep, 32" long and 9" high.

• • •

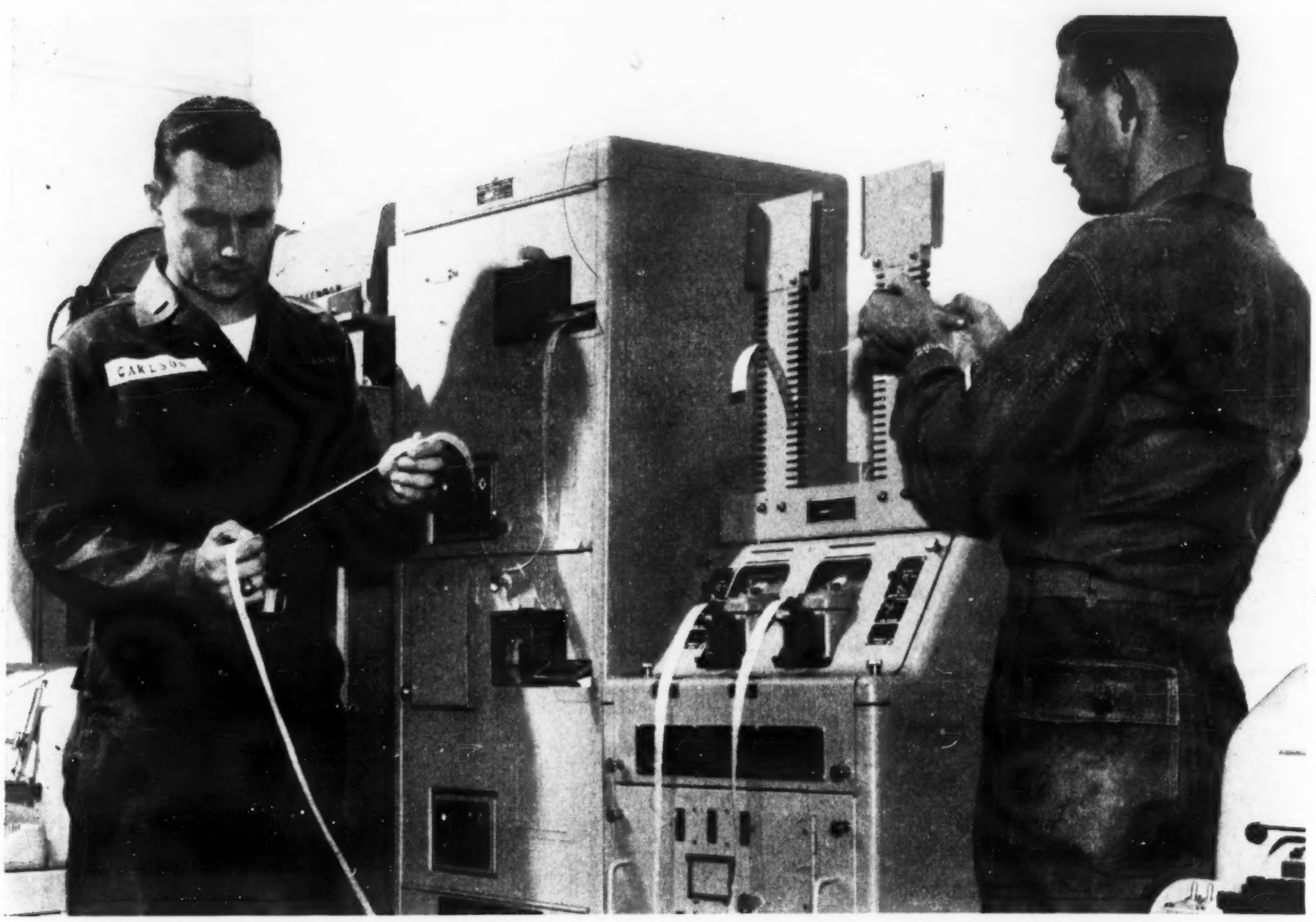
A tiny camera and 40 feet of Kodak film crammed into a "data capsule" in the nose cone of the Thor were responsible for the first movies of one space vehicle taken from another.

Taken at altitudes approaching 300 miles, the movies give a spaceman's view of the booster snapping from the nose cone, then falling away below as the cone continues upward.

In the background, the earth and its cloud cover are a hazy white half-circle outlined against the black void of space. The films are considered the first motion pictures of the earth

TOP LEVEL TALK

relayed on teleprinted tape



At U.S. Army field communications centers, Kleinschmidt torn tape relay units send, receive, retransmit messages to widely-dispersed commands

"Getting the word" from top command to outlying units in the field can create a communications traffic jam. This compact relay unit solves the problem. It quickly, accurately, automatically numbers and *prints* each message as it simultaneously *relays* another message to one or 100 receivers in the communications network! Developed in cooperation with the U. S. Army Signal Corps, the unit's applications include telemetering, integrated data processing, torn tape communication. In recognition of Kleinschmidt's high standards of performance, equipment produced for the U. S. Army is manufactured under the Reduced Inspection Quality Assurance Plan.

KLEINSCHMIDT

DIVISION OF SMITH-CORONA MARCHANT INC., DEERFIELD, ILLINOIS

Pioneer in teleprinted communications systems and equipment since 1911

from a space vehicle at this altitude.

Kodak Plus-X Reversal, a high-contrast motion picture film, was used and although soaked in the South Atlantic for over half an hour following the missile flight on May 12, it was developed successfully.

Kodak recommended that any slight fogging of the film by salt water could be kept to a minimum by placing the film in an air-tight container immediately after its recovery. It is said this precaution may have prevented the brine-sprayed film from drying out and cracking.

• • •

Moon probes, an astronautical reality that is just around the corner, will create an increasing need for familiarity with lunar geography. Because of the current scientific interest in the exploration of the moon, lunar geographical terms such as Mare Tranquillitatis and Ptolemaeur will soon become important landmarks for millions of Americans.

Anticipating the desire to locate key points of the lunar terrain, the Missile and Space Vehicle Department of the General Electric Co. has made available a technically accurate map of the moon. Measuring 35" x 45" and printed in blue and black, the moon map makes all charted geography of the visible side of the moon easily identified and located.

The map of the moon may be obtained, without charge, from the General Electric Company, Missile and Space Vehicle Department. Room 4C, 3198 Chestnut Street. Philadelphia 4, Pennsylvania.

• • •

Two-way radio contact on 222 megacycles between the Hawaiian Islands and the mainland, previously believed impossible by experts, is reported by two radio amateurs. The communications set a new world's record of 2540 miles. This surpasses by 1800 miles the previous record of 740 miles set in 1957.

Contact between Palos Verdes, Calif., near Los Angeles, and Kahuku, on the Northern tip of Oahu, in the Hawaiian Islands, was established on 222 megacycles, the evening of June 22, by Californian John Chambers, W6NLZ and Hawaiian Ralph Thomas, KH6UK. The frequency, located in the V.H.F. range is normally used for limited short-distance communications.

Attempts at the record began on June 18, with Chambers and Thomas using other amateur frequencies for liaison. The contacts lasted for 53 minutes beginning at 9:30 pm PDT. Successful two-way telegraphy communication and one-way on a voice-mode, known as "single-side-band," were made.

Chambers transmitted with a power of 750 watts input, while Thomas used 1000 watts input, the maximum legal power permitted American amateurs. Special receiving equipment was used at both ends. The signals were said to be "erratic" but reached "strong signal peaks."

Special transmitting-receiving antennas were employed for the mainland-Hawaii contacts, with both amateurs constructing much of their own equipment.

The American Radio Relay League said that tropospheric propagation made possible the record-breaking contact. The quality of signals received at both ends of the circuits indicated that weather conditions over the Pacific were responsible.

• • •

"**Semiconductor Relays** for High Speed Signalling or Data Current Control" are described in the Number 65 Rixon Engineering Bulletin by Rixon Electronics Inc., 2414 Reedie Drive, Silver Spring, Md.

Outstanding characteristics of the Rixon line of semiconductor relays are: interchangeable with WE 255 A or similar types; completely transistorized; extremely small size; have polar or neutral input and/or output; no a-c line power is required; control power less than one watt derived from keyed system; input sensitivity to 3 ma.; quick installation.

The bulletin also includes a block diagram illustrating the basic concept of a polar-in to polar-out relay equivalent and an illustration, description and specifications of Model SCR-60 Relay.

• • •

The complete redesign of the KA-20 aerial camera has provided Army reconnaissance drones and light manned aircraft with facilities for day and night aerial photography without the necessity for modification of the drones or airplanes.

Under a million dollar Army Signal Corps contract, Chicago Aerial Industries has completed redesign of and is now manufacturing 360 of the compact KA-20 aerial cameras. First units of the new version of the camera were recently delivered to the Army for testing.

For night photography, the shutter remains open until the illuminating flares are fired, when a photocell trips the shutter closed through an electri-

The 3rd Annual

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film & AUDIO-VISUAL

EXHIBITION

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FOUR THOUSAND ONE HUNDRED AND TWENTY SIX attended the 13th annual armed forces communications and electronics association's convention and benefited from valuable contacts and information—next year even more will have the same opportunity on may 24, 25, 26 when the 14th afcea convention will be held at the sheraton-park hotel in washington, d.c.

cal amplifier circuit housed entirely within the camera body. In order to prevent picture blurring due to the movement of the aircraft over ground area being photographed, the KA-20 is equipped with a simple form of image motion compensation. This device, called IMC, was originally developed by Chicago Aerial Industries and moves the film to synchronize with the apparent movement of the image at the moment of exposure.

Design of the night photo equipment within the original camera body dimensions of the KA-20 enables it to be used within the same mounting arrangements without any modification of the drone or light aircraft. The camera is designed especially for use in the Radioplane AN/SD-1 Drone and the Cessna L-19 Liaison Airplane.

• • •

A semiconductor alloy kit, designated Z-100, is now available from Accurate Specialists Co., Inc., 37-11 57th St., Woodside 77, N. Y., as an aid in speeding development of new devices and processes.

Priced at $100, the kit includes 24 different semiconductor alloys in various usable forms such as discs, spheres and washers, in excess of 25,000 preforms. Various pure elements and alloys are included and all alloys are packaged in argon for maximum shelf life and are documented so that they can be reproduced at a later time in large lots to meet subsequent production quantities.

By using this Z-100 kit, research engineers can now speed development of new devices and processes without the delays that setup costs previously encountered in procuring small lots of precise alloys.

• • •

An airborne device, called a polarization switch, that will filter out radar images of storms and heavy clouds and thus permit all-weather jet interceptor pilots to see their targets more clearly has been developed by the Westinghouse Electric Corporation.

This development will increase radar range between five and ten times the present maximum in storms, Dr. Patrick Conley, manager of the company's air arm division, said, adding that this is possible because it eliminates much of the "clutter" on the radar scope reflected from storms and clouds. Thus, the radar signal bouncing back from the target aircraft shows up proportionately better.

"The pilot will be able to flip a switch that will change the type of signal his radar will transmit," Dr. Conely explained. "One type of signal will be good for clear weather and give maximum range. The other, just developed into practical use, will greatly increase range in 'soupy' weather because reflection characteristics from this type of transmission tend to show only the target plane and not the great masses of rain clouds."

The new device can be mounted inside the radar antenna in the nose of all-weather interceptors. It will add almost no weight or size to the electronic system, according to reports.

• • •

A stretch cable produced in neoprene for special military and general purposes has been developed and is now available from Stretch Wire Corp., New Rochelle, N. Y. These new neoprene compliance cables, in one-and two-conductor constructions, have an easy extension and return of over 200%. One pound of stress produces a stretch of 50%, two pounds of stress, a stretch of 90%.

The two-conductor parallel construction, SWR-2, has a resistance of 0.15 ohms per extended foot and the circuit resistance does not change with a change of the length of the cable. Individual conductors are insulated to withstand 1,000 volts.

Designed for any application up to 75 watts, these cables are suitable for communication work, patch cords and telephone systems, and missile testing systems, in lieu of telemetering, where shock and vibration are important factors.

• • •

A new type of meteorological rocket has been tested by the U. S. Army Signal Missile Support Agency at the White Sands Missile Range, New Mexico. Production models will be made of finely spun glass fibers so that they may be fired over populated areas and exploded into harmless fragments after gathering the required data.

Four of the new rockets were test-fired and one attained a height of 174,000 feet—roughly 33 miles—with its full payload of instruments.

Named the All-Purpose Rocket of Collecting Atmospheric Soundings (ARCAS), the rocket was made for the Office of Naval Research and can be launched by a two-man crew. Seven feet long by 4½ inches in diameter, it weighs 71 pounds, complete with a load of slow-burning solid fuel. The launcher, which is also of a new type, resembles a mortar tube, 11 feet long, that will swing 360 degrees in azimuth and 20 degrees in elevation from the vertical.

Each of the four ARCAS rounds had a different purpose. One rocket contained a telemetry instrument package that radioed back information about the air flow around the rocket, about the earth's magnetic field at high altitude and about combustion chamber pressures. Another firing was made to measure wind speeds. A radiosonde was placed in the third rocket's nose cone and this tiny transmitter sent back important data on temperatures in the regions above the 100,000-foot level.

In this experiment, it was possible to estimate the airframe position by the intensity of the radio signal. Strength of the radio signal varied according to the position of the directional antenna fastened on the rocket as it traveled through space.

The instrumentation payloads in these tests averaged 12 pounds, representing a very high ratio of instrumentation to the rocket's total weight. ARCAS will be developed to carry payloads of this weight as high as 206,000 feet.

• • •

A new magnematic sound/slide projector has been announced by the Amplifier Corp. of America, 398 Broadway, New York 13, N. Y.

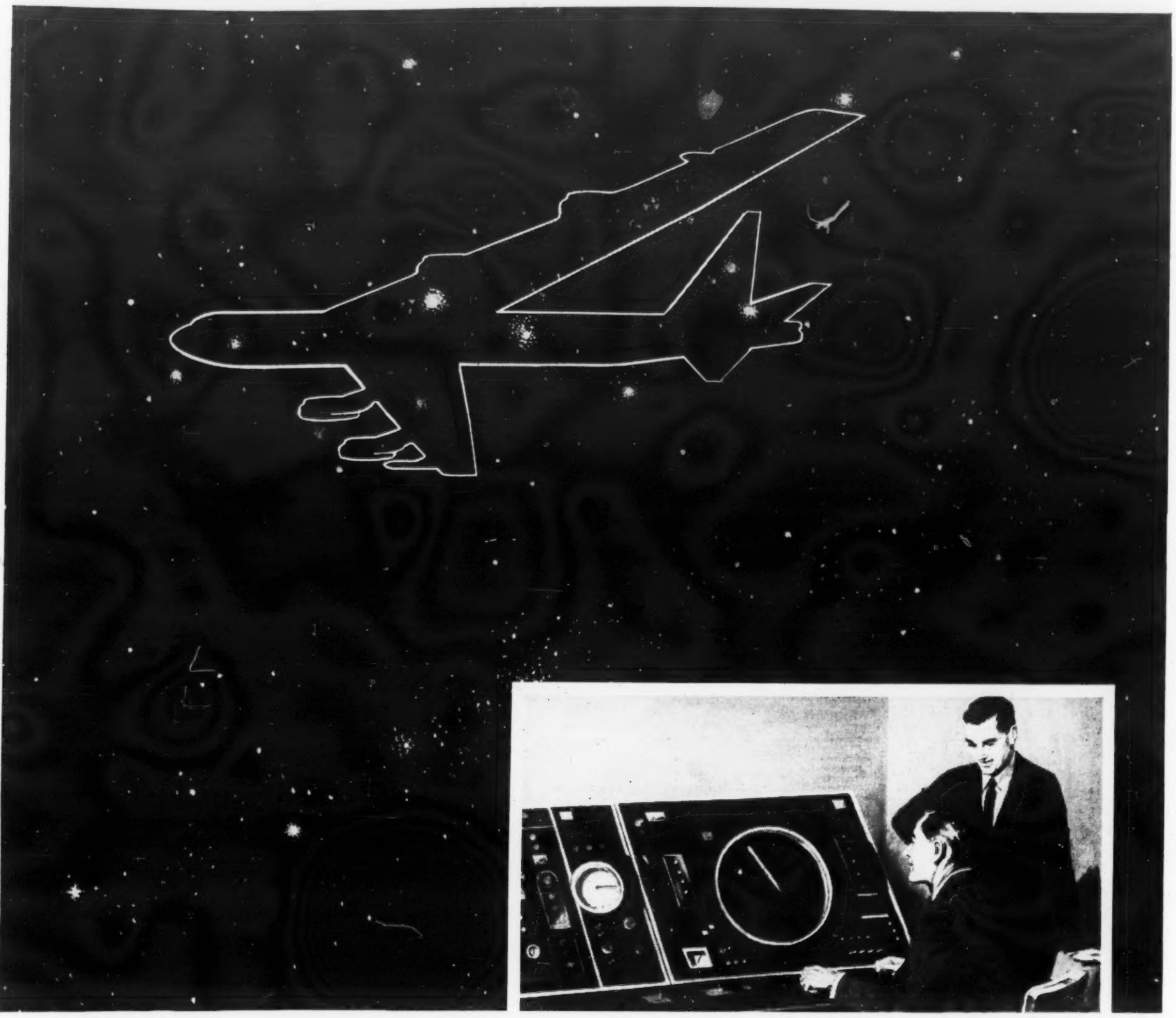
The new unit, claimed to be the first fully automatic sound synchronized slide projector, features a one-piece integrated construction of an automatic tape-cartridge record-play mechanism and a 500 watt projector. Models are available with monophonic or stereophonic record-play facilities utilizing two, three, or four tracks on ¼ inch magnetic tape. Depending upon tape speed, record-play time of various models ranges from 30 minutes to 8 hours.

A separate built-in recorder (on record-play projectors) permits programs to be produced with the projector and subsequently played back on the same or other playback projectors. During recording, the slide change is manually controlled (either remotely or locally). Each slide change automatically puts a 20 cycle control tone on the same, or an adjacent track. During playback, the control tone automatically changes the slide in precise synchronism with the original timing.

The master program may be mass duplicated at high speeds by conventional economical methods.

The projector will automatically

SYLVANIA ELECTRONIC SYSTEMS . . . **IN SIMULATION**



Creating electronic "realities" in a low-cost manageable package

SIMULATING CONDITIONS of actual operations for flight trainers, radar operators, or space travelers is an experienced and growing facility of Sylvania Electronic Systems.

Good examples are Sylvania's participation in the Navy's Universal Digital Operational Flight Trainer and "ACTER," a new Sylvania development which will add ECM conditions to existing radar training gear.

Undoubtedly the simulation of space travel can be enhanced materially by current simulation projects.

In simulators or trainers, as in every major area of electronic systems, Sylvania can assume full responsibility from system analysis and management through research and engineering, product design, production to field engineering.

Sylvania welcomes the opportunity to outline its special talents and capabilities to you or your organization personally. *Simply address your inquiry to division headquarters, address below.*

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63 Second Avenue, Waltham, Mass.

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

handle up to 40 2 x 2 inch and 2¼ x 2¼ inch slides. A 500-watt blower-cooled lamp is used in conjunction with a 5 inch F/3.5 lens. Models are available with or without power amplifiers (choice of 3, 5, or 10 watt output).

• • •

A completely static sequencer for control of the Polaris missile countdown, capable of triggering 60 checkout operations per minute, has been developed by Magnetic Amplifiers, Inc.

Constructed for the Missile and Space Division of the Lockheed Aircraft Corporation, the device is used to provide over-all control of other missile ground checkout equipment. Containing no moving parts, it issues its commands consecutively, compares information received in response to its orders and verifies accuracy of test results.

Employed in activities dealing with "the supporting launching and handling" of the Polaris intermediate range ballistic missile, the static sequencer also has industrial applications in the fields of food processing, equipment testing, data handling and automated machinery.

The sequencer is said to be 40% more efficient than present non-static devices used for the same purpose. It contains no vacuum tubes and has no contacts to wear or burn out. Developed in cooperation with Lockheed engineers, it was designed to obtain "the reliability essential in space age equipment."

Lockheed is missile system manager and prime contractor for the Polaris.

• • •

"Quiet-Ear," a unique new ear protector distributed exclusively by Bausch & Lomb, has been developed by RCA to meet the need of personnel who work near loud noises.

The design of "Quiet-Ear" marks a new concept in ear protection, since it uses neither bulky absorbing materials, nor excessively large sealing shells. Applicable anywhere, where noise becomes a hindrance or a nuisance, this lightweight, sanitary and inexpensive ear protector offers optimum noise protection.

For more information on noise protection, write to Safety Products Department, Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, New York.

• • •

A computer, featuring adjacent area controls, has been developed by General Telephone Laboratories to automatically rate toll calls in a SATT installation.

Designated the Type 59 SATT Computer, the new unit, supplied by Automatic Electric Company, features six digit, area code plus office code, analysis of calls terminating in adjacent areas. The circuit can be arranged to handle several numbering plan areas but is usually limited to the one or two adjacent areas that terminate a significant volume of SATT calls. An adjacent area relay circuit is provided for each such area.

• • •

Microwave Associates, Inc., of Burlington, Mass., has developed a 1 megawatt peak, 1000 watt average power ferrite duplexer for use in X-band radars operating in the 8500 to 9600 Mc frequency range. It features a crystal protector TR tube custom-matched to a Microwave Associates ferrite circulator for optimum electrical performance at the full-rated power condition.

This MA-124T duplexer, weighing 4 lbs. 8 oz., includes a life warranty for the crystal protector of 500 hours minimum and has a 2-microsecond maximum recovery time. The electrical ratings apply over a temperature range of −50°C +85°C.

Specifications on this and 38 other ferrite duplexer devices are available in Bulletin 59F from Microwave Associates, Inc.

• • •

An electronic computer and accessory equipment to assist in nuclear weapons research and development have been installed at Kirtland Air Force Base, N. M.

Engineers of the Computer Division of Bendix Aviation Corporation said the general-purpose G-15 digital "brain" will be used by the Air Force Special Weapons Center's Analysis division to help solve nuclear energy problems related to weapons by simulating their performance and providing informative data for evaluation.

One of the main objectives of the Center, a part of the Air Research and Development Command, is to see that each weapon under development has the right warhead for its specific job. Electronic computing and evaluation, which eliminates much of the costly field testing, will be used to determine these factors as well as speed the decision.

The AFSWC mission at Kirtland also includes applied research on blast effects and development of protective shelters, radiation hazards and development of operational radiation measuring devices.

• • •

Immediate availability of the RCA developmental Nuvistor small-signal triode tube to electronic equipment manufacturers on a limited sampling basis has been announced by the RCA Electron Tube Division. (See SIGNAL, April 1959, P. 48).

A small-signal tetrode and a beam power tube of the Nuvistor design for entertainment, industrial and military applications are under development and will be available on a sampling basis at a later date.

• • •

A new concept in image quality is possible with Versapan, a new fine grain black-and-white sheet film by Ansco, Binghamton, N. Y., the photographic manufacturing division of General Aniline and Film Corp.

This all-purpose speed sheet film produces premium quality negatives under a multitude of conditions with exposure indexes of Daylight 50 and Tungsten 40.

The color sensitivity of Versapan is balanced to approximately that of

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BOX 126

WOOSTER, OHIO

Radioplane drones shown left to right: XQ-4B; RP-76; RP-77D; OQ-19; SD-1

RADIOPLANE CREATES FIRST FAMILY OF UNMANNED AIRCRAFT TO TRAIN MEN, EVALUATE WEAPON SYSTEMS, AND SURVEY ENEMY TERRITORY

Radioplane is the world's leading producer of drones and space age recovery systems. As live targets, drones perform as aircraft–then can be recovered by parachute. As evaluators, drones simulate the appearance of the enemy threat while they score our weapon systems' effectiveness. On surveillance missions, drones are zero-length launched, fly cameras, take photos, and return with information within minutes.

For 20 years Radioplane has led in the production of drones. Radioplane's leadership in the field typifies the years-ahead thinking that continues to produce design concepts for tomorrow, hardware for today–developed, produced, and delivered on time – at minimum cost to the taxpayer.

RADIOPLANE

Van Nuys, California, and El Paso, Texas

A Division of **NORTHROP CORPORATION**

SPACE COMMUNICATION ANTENNAS

ANDREW

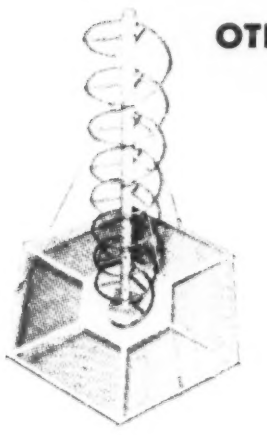
Quad-Helix antenna

tracks long and medium-range missiles

Telemetry circuits between missile (or satellite) and ground station are reliably maintained with the ANDREW Quad-Helix Array. This system offers low VSWR, high gain, and easy control.

Gain is 17.5 db at 265 mc, 14.5 db at 215 mc. VSWR is less than 2.0:1 across this range. Polarization is right hand circular; impedance 50 ohms. Counterbalanced rotator provides 180° elevation and 720° azimuth tracking at speeds from 0° to 30° per second.

Optional remote control unit regulates speed and direction.



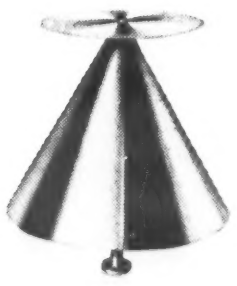
OTHER ANDREW GROUND-AIR ANTENNAS

TRI-HELIX ANTENNA

880-990 MC 17.5 DB GAIN TYPE 81068

HELIX ANTENNAS

FREQUENCY	GAIN	TYPE NUMBER
108-132 mc	12 db	H 19110 A-1
215-265 mc	10.5 db	H 50140 A
215-265 mc	13 db	H 19110 A-2
260-320 mc	13 db	H 19110 A-3
320-400 mc	13 db	H 19110 A-4
400-500 mc	12 db	H 19110 A-5



DISCONE ANTENNAS

FREQUENCY	TYPE NUMBER
25-50 mc	50154
50-108 mc	51150
108-215 mc	19050-1
215-420 mc	19050-2
420-1000 mc	19050-3

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the human eye. It is an excellent choice for color separation work as its panchromatic sensitivity is balanced to equally record red, blue and green with undistorted tonal relationships.

The high resolving power of Versapan (in excess of 90 lines per mm) puts it in the same class as special purpose films used for scientific applications. Its remarkable grain structure and tonal range is achieved with normal developers at normal developing times (4-6 minutes in Isodol Developer).

Versapan is available in the following sizes: 4″ x 5″, 5″ x 7″, 8″ x 10″, 11″ x 14″, 2¼″ x 3¼″ and 3¼″ x 4¼″.

• • •

An offer to provide American radio manufacturers with license rights to the "Banshee" Fallout Alarm on a no-cost basis has been made by S. S. Auchincloss, President of Tracerlab Inc., Waltham 54, Mass.

The Banshee is a small low cost fallout alarm designed for incorporation in civilian radio receivers to warn of the presence of dangerous levels of radiation following an atomic attack and is said to be the most practical home fallout device yet devised. A prominent official of the AEC has estimated that such a device might save 10 million American lives in the event of atomic attack.

The heart of the Banshee is a small cadmium sulfide crystal about the size of the head of a pin. This crystal is incorporated into a simple inexpensive circuit which is connected to the audio circuit of any radio. Under ordinary conditions, the Banshee is dormant and the radio functions in its usual manner. In the presence of a dangerous amount of radiation, the crystal generates a signal which causes the loud speaker of the radio to emit a high pitched wail. This signal is heard at every position of the radio dial and its pitch varies with the intensity of radiation present.

• • •

A handy guide to Eastman Kodak Company photographic publications has been revised to include recently-added titles. Titles of publications on general and specific photographic subjects are listed and brief descriptions of their contents, their number of pages and the list price for each are given.

"Kodak Books And Guides 1959" (L-8) is available from Kodak dealers or from the Sales Service Division, Eastman Kodak Company, Rochester 4, N. Y.

AN ACHIEVEMENT IN DEFENSE ELECTRONICS

NEW AMPLIFIER CUTS NOISE TO BOOST RADAR RANGE 40%

This new solid-state parametric amplifier made possible the reception of Pioneer IV signals through more than 407,000 miles of space. Because the easily tuned amplifier cut receiver noise to a mere whisper, General Electric's tracking station accomplished the feat using a standard 18-foot dish antenna. This was four days after blast-off, with the satellite transmitting a signal of less than two tenths of a watt.

Since that time, G-E parametric amplifiers have been applied to existing radars and have reduced input noise by 6 db—equivalent to a 400% transmitter power increase or a 40% addition to effective range. Achievements such as this continue to prove General Electric's outstanding technical competence in defense electronics. 227-1

Progress Is Our Most Important Product

GENERAL ELECTRIC

DEFENSE ELECTRONICS DIVISION
HEAVY MILITARY ELECTRONICS DEPARTMENT
SYRACUSE, NEW YORK

Little known outside of the Pacific Area, the Trust Territory of the Pacific Islands, Department of the Interior, operates a communications system over an area somewhat greater than the United States.

The system operates on a 24-hour day, providing administrative communications, aeronautical services, ship-to-shore communications, distress surveillance and communication services to the various Armed Forces. It plays a vital part in the Pacific weather-forecasting program.

The system consists, primarily, of four major traffic stations, a major relay and control station, one broadcast station, eighteen secondary stations, six radio-equipped seagoing vessels and numerous radio-equipped small craft. It is staffed by eight Americans and forty-five native operators. Modes of transmission include radiotelegraph, radioteletype and radiotelephone (AM and SSB).

The Trust Territory Government, Truk, ECI, is an agency of the Department of the Interior. However, its communications service parallels that of a country inasmuch as it has communications laws and regulations. It licenses and regulates non-government services such as point-to-point, maritime and amateur stations.

Approximately 75,000 messages pass over its circuits annually, with around 1500 hours of radio-conferences.

• • •

A miniature radar-like device that detects and measures movements up to thousands of feet away was demonstrated for the first time publicly recently by the Singer Military Products Division.

Named the Standing Wave Area Motion Indicator (SWAMI), the device is small enough to fit into an attache case and is said to be "virtually impossible to confound with countermeasures."

The SWAMI sensor is a sealed vacuum tube envelope containing an ultra-high frequency radio oscillator pulsed at a low frequency repetition rate. This apparatus is shock resistant and its service life will compare favorably with that of vacuum tubes used conservatively in more conventional applications.

Any motion in or intrusion into the area under surveillance induces a change in the low frequency repetition rate which, in turn, is detected by an FM detector. The detector transmits this intelligence to the monitor in a central control station in the form of voltage fluctuation of high amplitude, touching off the alarm.

Any attempt to tamper with the connecting cable leading from sensor to monitor will actuate the alarm.

Power source for the sensor may be either an ordinary household 115-volt outlet or a battery with enough power to supply an ordinary household night light. Any type of battery, wet or dry cell, will serve.

SWAMI was designed by Louis B. Mulvey.

• • •

A Service by Ampex

If you want to record something for posterity, there is a pretty good chance that Ampex will provide the means. The big event of the final day's program at the AFCEA Convention (Friday, 6 June 1959) was the Industrial Luncheon scheduled for 12:30 P.M. in the Sheraton-Park's Grand Ballroom. The speaker was J. Carlton Ward, Jr., President of Vitro Corporation of America.

At 11:30, a check was made on our recording facilities only to find something was wrong—the hotel had no recording equipment. Confronted with a difficult situation, a phone appeal was made to Jack Miller, Shows Manager of Ampex's Professional Products Division, who was with the Ampex Videotape Cruiser parked outside the hotel in the Exhibit Court throughout the convention. Could Miller help? Could Ampex record Mr. Ward's speech?

Almost before the phone call was completed, Miller, assisted by Phil Thorton and Chuck Swisher of the Videotape Cruiser staff, had run 500 feet of audio cable from the cruiser into the ballroom of the hotel. With microphones (also supplied from the cruiser) and an Ampex 601 audio tape recorder inside the cruiser, facilities were set up to record Mr. Ward's speech long before the waiters started serving the appetizers. All 43 minutes of Mr. Ward's address went on magnetic tape.

During the three days that Miller and other Ampex representatives demonstrated the Videotape Cruiser, more than 700 convention delegates and visitors inspected the equipment and watched it in operation. The Ampex unit is a completely self-contained, fully mobile air conditioned facility for tape recording and playback of television programming anywhere in the world.

Names in the News

Lieutenant General James D. O'Connell, who recently retired from the post of Chief Signal Officer, U. S. Army, has become a consultant to General Telephone & Electronics Corporation. General O'Connell will undertake a comprehensive study of the research and development personnel and facilities of the organization.

Virgil R. Rogers, who as a first lieutenant was the first man to flight test the Signal Corps' 100 inch AN/FPH-2 aerial camera, was awarded the Army Commendation Ribbon for his active duty service. Mr. Rogers, who became a civilian employee of the Chief Signal Officer's avionic testing facility after his release from active duty, was Engineer in Charge of Aerial Photographic Equipment Evaluation.

Lieutenant Colonel Robert J. Hennessy, former Air Force Editor of SIGNAL, has returned to Washington as Executive Officer, Director of Communications-Electronics, DCS/Operations, Headquarters, USAF.

Carl E. Calohan has been appointed Advertising and Sales Promotion Manager of Giannini Controls Corporation, succeeding **Richard L. Lawrence** who resigned to accept a similar position with Hughes Semiconductor Products.

Ralph I. Cole, Manager of Military Project Planning, Melpar, Inc., recently was elected Chairman of the Washington, D. C. Council of Engineering and Architectural Societies.

J. Frank Price has been elected Vice President-Operations and to the Board of Directors of the Pleasantville Instrument Corporation. Mr. Price joined General Precision Laboratory Incorporated, the parent company, in 1951.

Emerson E. Mead recently was elected Executive Vice President of Smith-Corona Marchant, Inc.

Brigadier General Earle F. Cook has been appointed Deputy Chief Signal Officer of the United States Army. Prior to this appointment, he was Chief of Research and Development, Office of the Chief Signal Officer.

As we go to press, we salute new **Maj. Gen. A. F. Cassevant,** and new **Brig. Gens. Hayes** and **Charles,** all Signal Officers, USA.

4 ESSENTIAL CONSIDERATIONS—

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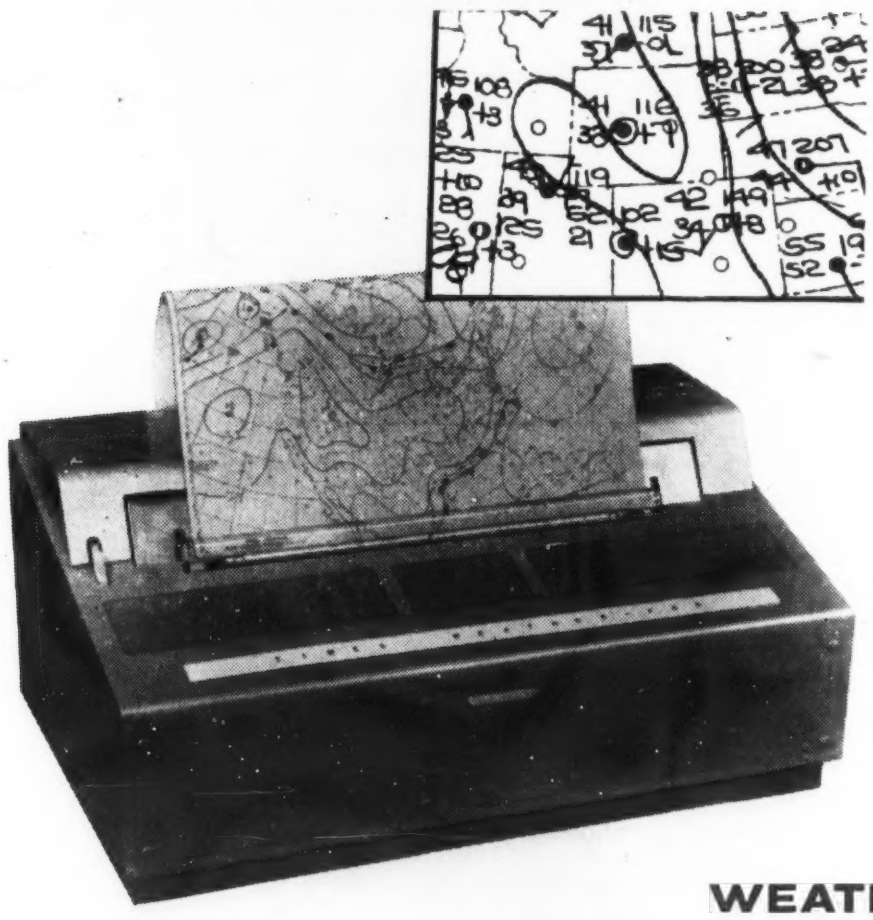

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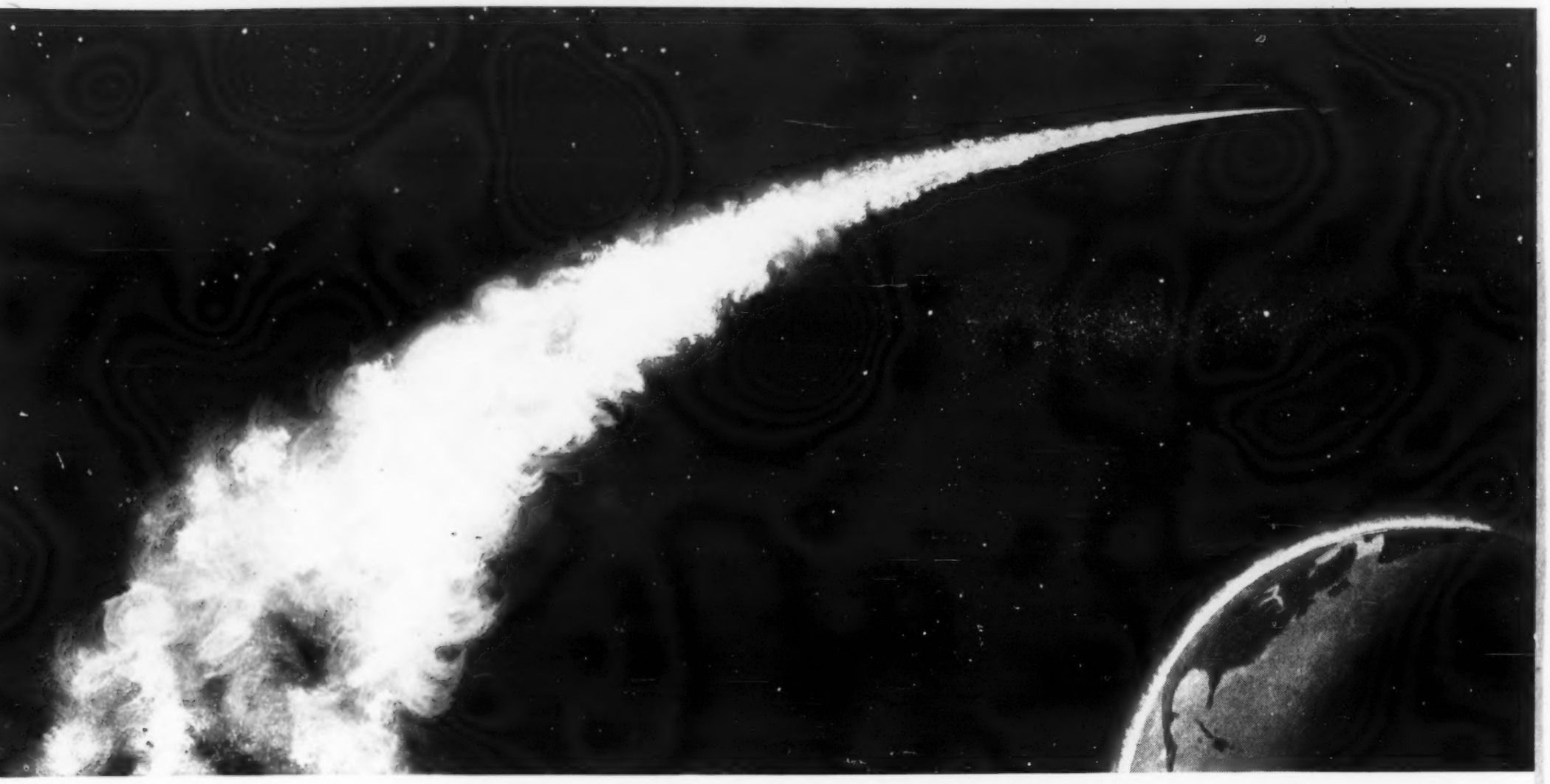

Dyna-Soar (for dynamic soaring) is a joint project between the Air Force and the NASA, and is an attempt to solve the technical problems of manned flight in the sub-orbital regions. Advance knowledge on the project indicates how a boost-glide vehicle can operate from the outer fringes of the atmosphere where it can maneuver and be recovered undamaged. Studies show that by varying the original rocket boost, and thus the velocity, and with the control available to the pilot, the Dyna-Soar aircraft can circumnavigate the earth, followed by a normal and controlled landing. Boeing Airplane Company, one of the competing companies for the development contract for the complete boost-glide system, has delegated to RCA the responsibility for the development of important electronic components of Dyna-Soar.

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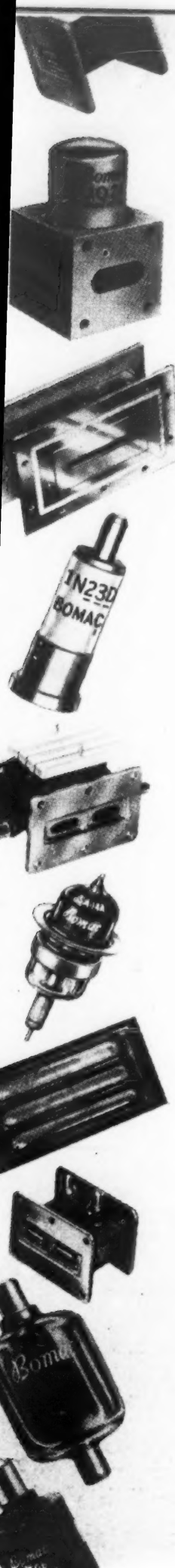

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